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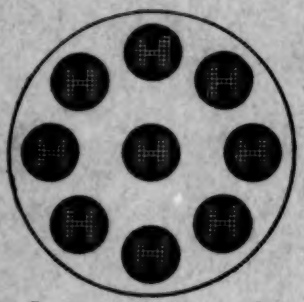

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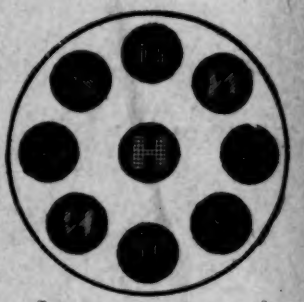

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AMERICAN JOURNAL OF OPHTHALMOLOGY

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# ANEURYSM OF THE INTRACRANIAL PORTION OF THE INTERNAL CAROTID ARTERY.

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NEW YORK, N. Y.

A man of sixty, who thirty-four years previously had suffered fracture of the skull from a fall on his head, leaving permanent immobility of the right eye and ptosis, now came for pain in and about the eye. He was under observation nearly three months, when he died of anemia. Autopsy showed aneurysm of internal carotid just above the cavernous sinus. Abstracts are given of the four cases observed in Cushing's series of 1,280 intracranial tumors. This case and specimens were presented before conferences of surgeons of the New York Eye and Ear Infirmary and Second Medical Division (Cornell) of Bellevue Hospital.

Harvey Cushing remarked that "intra-cranial aneurysms of the sacculated variety are far less rare than is commonly supposed, tho it is most unusual for the clinician at the bedside even to suggest the possibility of such a diagnosis". The following case will present the difficulties of a positive diagnosis.

Patient J. D., age 60, laborer, sought relief from severe pain in and about the right eye at the clinic of Dr. John M. Wheeler at the New York Eye and Ear Infirmary on Jan. 2, 1923.

He related how 34 years previously he had suffered a fall, landing upon his head. He was taken while unconscious to a hospital where a diagnosis of fracture of the skull was made. After consciousness was restored, it was noted that the right eye was immobile, that there was ptosis of the right upper lid and that hearing on the right side was absent.

These defects persisted thruout the patient's life. Aside from these, he was well and strong until in December, 1922, when after a drinking bout, he began to have severe, constant, stabbing pain in and about the right eye, radiating to the temporal region, upper right face and right forehead. There was associated also a sensation of numbness in the same regions. Examination showed complete paralysis of the right 3rd nerve with ptosis and mydriasis, right 4th and 6th with diplopia and loss of accommodation. There was complete anesthesia in the region of the 1st and 2nd divisions of the right 5th. Neuroparalytic keratitis was present. The pain was not allayed by sedatives and was constant until the middle of February when it suddenly ceased. The keratitis responded to local treatment and the abraded epithelium healed over.

On January 30th, the patient contracted acute bronchitis with signs of bronchopneumonia and was taken to Bellevue Hospital. His cardiac sounds were faint but the heart was not enlarged. On Feb. 10th, a systolic murmur was present for a short time. His blood showed red corpuscles varying greatly in size and shape. A differential count showed myeloblasts 80, large mononuclears 4, small mononuclears 12, polymorphonuclears 4 to the hundred cells. The white cells numbered 4000 per cmm. while the red cells numbered 1,976,000 with hemoglobin of 55% giving a color index of 1.3. These blood findings were verified by subsequent examinations. His blood pressure was not elevated.

Neurologic examination showed the olfactory sense normal. Vision R. 20/200, L. 20/30. The right field showed an irregular contraction, the inferior portion being encroached upon to 40 degrees. The left field was not contracted. These fields remained practically unchanged except for slightly more involvement of the right inferior field. Due to the paralysis of the extrinsic ocular muscles of the right eye, diplopia could be induced

with a red glass before either eye and homonymous diplopia was found as the object was carried to the right, crossed as it was carried to the left, a left diplopia in the upper fields and a right diplopia in the lower fields.

The presence of referred pain in the anesthetic area of the ophthalmic and maxillary divisions of the 5th nerve was interpreted as anesthesia dolorosa. The mandibular sensory and motor branch was not involved. The intraocular tension of the right eye was 9, that of the left eye was 18. The pupils were unequal, right larger than left. The right did not respond to direct or consensual light reflex or to accommodation. The left responded to direct and consensual light and to accommodation. There was no exophthalmus or pulsation of the eyeball. He had never suffered from head noises. A bruit was not listened for either over the eye or over the skull. The fundi showed on the right a disc slightly paler than the left. Other than this and the evidence of the vascular thickening, the fundi were negative at the onset. Ten days before death, striate linear hemorrhages appeared in both retinae. There was never any appearance of papilledema.

The 7th nerves were intact. The 8th nerve showed on the right loss of hearing with loss of bone conduction. The cochlear function was abolished while the vestibular function was intact. Nystagmus of the right eye was not produced, but typical reactions were elicited in the movements of the left eye by the caloric test on the right ear. The left 8th was intact. He had no aphasia either sensory or motor. 9th, 10th, 11th and 12th cranial nerves were intact.

He had no general sensory or motor disturbances except a general weakness due to his anemia. He had no abnormal attitudes or abnormal involuntary movements. There was no disturbance of coordination, no apraxia, no ataxia. His general glandular system was negative. There was no evidence of disturbance of the pituitary body function.

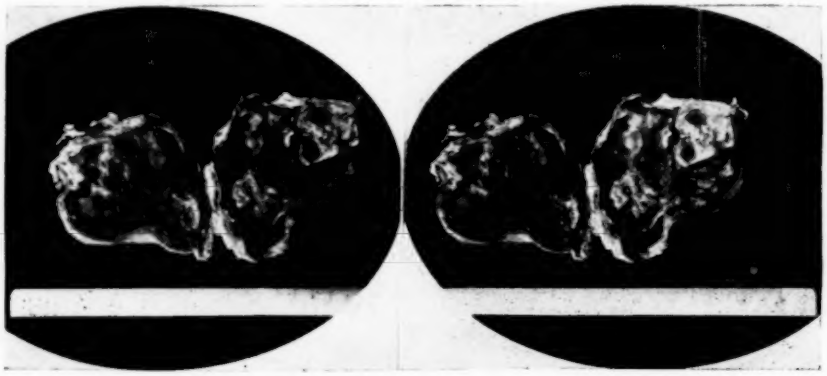

Fig. 1.—Stereoscopic photographs of bisected aneurysm. The fully organized areas and the more recently clotted areas can readily be seen.

X-ray examination of the skull by Dr. Geo. S. Dixon showed a mass in the right middle cranial fossa eroding the sella, and the floor of the middle fossa. An old fracture thru the lesser wing of the left sphenoid was demonstrated. No extension thru the floor of the cranial cavity was made out and examination revealed no mass in the nasopharynx or in the spenoidal sinus. The case was clinically one of an intracranial expanding lesion complicated by severe anemia and was so diagnosed.

The patient died at Bellevue Hospital on March 28, 1923 from the effects of his anemia. At the autopsy the skull was opened and adhesions were found between the dura and calvarium. On removal of the brain, the under surface of the right temporo-sphenoidal lobe presented a rounded depression about 4 by 5 cm. which had been caused by an aneurysm of the right internal carotid artery almost entirely

fully organized, with a small area of organizing and fresh blood clots. Its origin was from the artery just above the exit from the cavernous sinus. The wound of the vessel wall had apparently happened at the time of the accident and the aneurysm had formed at that time, causing the destruction of the 3rd, 4th and 6th nerves. There apparently had been almost complete organization of the mass and circulation had gone on thru a small channel until the fresh hemorrhages occured into the mass, increasing its size, pressing on the Gasserian ganglion, causing the pain and anesthesia. No channel for the circulation thru the aneurysm was found at the time of autopsy.

Fig. 2.—Stereoscopic photographs of aneurysm placed in proper position in another skull to show relations to the surrounding structures.

The mass of the aneurysm occupied practically the whole of the inner half of the middle fossa, the outer being free. The anterior and posterior clinoid processes on the right side had been destroyed. The floor of the middle fossa coresponding to the under surface of the mass presented a fine superficial erosion of the bone. The position of the right optic tract in view of the absence of greater defect in the field of vision was interesting. The tract was well preserved, of normal rounded contour, but running up and over the inner surface of the mass. The chiasm was not involved. The 3rd, 4th and 6th nerves were apparently destroyed by pressure. The 7th nerve was not involved. The cause of the unilateral nerve deafness was not established. The right cavernous sinus was not thrombosed. There was no connection between the aneurysm and the cavernous sinus.

The mass cut as if firm. It was composed of an external rim of whitish or cream colored tissue varying in thickness from 1 to 3 cm. Inside of this, there was a large quantity of firm, greyish red, partially organized blood clot. At the periphery were several rather large semilunar shaped areas of recently clotted blood. Microscopic sections presented the picture of organizing blood clots and dense scar tissue. A further examination of the body was not permitted.

### REVIEW OF CUSHING'S SERIES OF FOUR CASES.

In Cushing's entire tumor series of 826 histologically verified tumors, 454 unverified ones, and possibly an equal number of cases at one time or another under suspicion of harboring tumor, there were recorded four proven examples of sacculated aneurysms, all of them having originated near the bifurcation of the internal carotid into the anterior cerebral and anterior communicating vessels.

A resumé of these four cases will prove of great interest in considering the author's case.

Case No. 1 was a patient regarded previously as having a pituitary adenoma, in whom an aneurysm of the internal carotid was an unexpected postmortem finding. The history so far as the aneurysmal symptoms are concerned is imperfect. There was a defect in the field of vision on the side of the lesion, and the patient's death had occurred without rupture of the aneurysm.

Case No. 2 was that of a woman of 52 years who had a presumptive diagnosis of pituitary tumor made. She had a central scotoma and complained of an ache and pain on the right of her neck, which had come on at the same time as her disturbance of vision about four months previously. The posterior clinoids showed some rarefaction. During the next few months her visual loss was progressive and during an operation by a surgeon in another city there was disclosed what was mistaken to be a glioma. A few months later she had a "stroke" with coma and died. At autopsy there was found a sacculated aneurysm which had arisen from the internal carotid and had compressed the chiasm.

In these two cases as Cushing pointed out there were none of the symptoms of intracranial aneurysm upon which one might reasonably make a positive antemortem diagnosis; symptoms which in reality are those indicating the rupture of an aneurysm.

In the third and fourth cases of the series however, the indications were as he stated "sufficiently clear, but even so, the diagnosis was not even suggested."

Case No. 3[2], a girl of 27 years who suffered, seven weeks before admission, severe pain of sudden onset on the right side of her head, neck, shoulder, arm and hand, followed in a few hours by diplopia, right ptosis, and numbness of the right brow and cheek. After admission she had occasional attacks of vomiting and vertigo with continuous discomfort in the back of the head and lowered vision. The positive findings were a complete right ophthalmoplegia with ptosis and immobile pupil; hypesthesia of the right supra— and infraorbital skin fields; systolic blood pressure 200. The urine was negative, likewise the Wassermann reaction. A lumbar punture had been made before admission and showed, according to the report, 30 cells but no blood. X-ray was negative. The visual fields were normal. An exploration was made in the subtemporal region; and on incising the dura low down in the fossa the wall of a pulsating aneurysm was disclosed. She was discharged unrelieved and died suddenly a year later. No autopsy.

Case No. 4[a], a woman of 52 years, The onset was apparently about sixteen months previously, when she suffered from severe headache, pain in the back of the neck and vomiting, tinnitus on the right side and partial deafness. She was confined to bed for four weeks and during convalescence was giddy and her gait was unsteady for some time. The headaches persisted and were increasing in severity. Diplopia, diminished visual acuity and failing memory were noted about eight months after onset. About two weeks before admission she was seized with sudden severe pain in the right supraorbital region. This persisted and for the first three days was accompanied by frequent vomiting, ptosis and some protrusion of the right eyeball. Examination showed: Temp. 99.8 F., pulse 88, resp. 20; blood pressure, systolic 185, diastolic 110; urine negative, except for an occasional hyalin cast; blood Wassermann negative.

The visual acuity could not be tested (owing to lack of cooperation) and the visual fields were only roughly estimated, but were regarded as normal. The fundus oculi showed venous engorgement on the right side, blurred disc margins, and some exudate in the retina and arterial thickening. The left fundus presented similar findings except that there was no exudate found. Complete right 3rd and 4th nerve paralyses were found. Hearing was defective on the right side. The

other cranial nerves were negative. Her general sensory and muscular systems were negative. Deep and superficial reflexes were normal. Three days after admission she suffered two attacks of unconsciousness, rallying from each. On the following day she showed signs of an irritative lesion at the base of the brain. The fundus changes grew more marked, the right external rectus became paralyzed and coma intervened.

A right subtemporal decompression was done. A tense dura was found which on being opened revealed recently clotted blood apparently coming from the base of the skull. Death occurred in the morning of the following day, and at autopsy a small ruptured sacculated aneurysm was found at the junction of the right internal carotid and posterior communicating arteries.

Cushing[4] stated that "obviously the neuro-surgeon is not likely unexpectedly to encounter one of these aneurysms, for they rarely produce symptoms until there has been leakage." However, in each of his cases there were signs and symptoms that were directly traceable to the presence and pressure of the aneurysmal sac. Also in review of Symond's report, aneurysm should always be considered in a differential diagnosis, when an apoplectic attack or series of attacks of comparatively sudden onset is followed by symptoms pointing to the region of the internal carotid in its intracranial portion; namely, a unilateral ophthalmoplegia with ptosis and occipitofrontal pain associated with lowered sensitivity of the upper trigeminal skin field. Should there be in addition subhyaloid retinal hemorrhages and should the cerebral spinal spaces be found to contain free blood or even xanthochromia in the intervals between the hemorrhages, a diagnosis of intracranial aneurysm of the internal carotid artery is reasonably certain.

SUMMARY.

In a case presenting evidence of a tumor at the base, aneurysm should be suspected and considered in a differential diagnosis. If there be also the signs of leakage from the sac, the diagnosis is reasonably certain.

In Cushing's entire tumor series there were but four proven examples of sacculated aneurysm.

The author's case was one in which the size and localization of the tumor were known but in which a positive diagnosis of aneurysm could not possibly be made antemortem.

The author's thanks are due to Dr. John M. Wheeler, to Drs. Douglas Symmers and Eugene DuBois of Bellevue Hospital and to Mr. E. B. Burchell of the New York Eye and Ear Infirmary.

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# THE EFFECT OF THE PIN-HOLE DISC UPON VISION WITH THE PUPILS DILATED.

WILLIAM M. BANE, M.D.

DENVER, COLO.

The effect of the size of the aperture by which light is admitted to the eye upon the distinctness of vision under different conditions of illumination has been studied. The results of experiments with regard to it are here reported chiefly in tabular form. But the principal practical results are stated in the text. A thesis submitted as candidate for the degree Doctor of Ophthalmology in the University of Colorado.

For many years it has been an established fact that the pin-hole disc is a useful agent in the study of impaired vision and its causes, but not until recent years has much time or space been given over to the detailed study of the relationship existing between the size of the pupil, either natural or artificial, and the visual acuity. Jackson states that the pin-hole disc may be used to determine whether impaired vision is

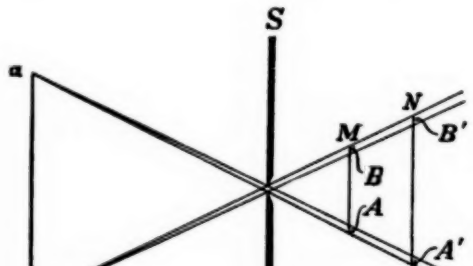


Fig. 1.—Formation of pin-hole image.

caused by organic changes in the eyeball or in the nervous mechanism of the optic nerves, tracts or centers; or whether it is largely due to imperfect focussing. When due to imperfect focussing, the vision may be impaired for all distances, and still be improved when looking thru the minute opening of the pin-hole disc. More than forty years ago Prof. Wm. Thomson modified the experiment of Schreiner for determining the amount of ametropia by means of two pin-holes placed side by side, the distance between them being less than the diameter of the pupil.

Louis Derr, in his recent book on photography, devotes a chapter to the study of pin-holes and their use in photography. From his article we obtain the following information. For obtaining a real picture of an object the pin-hole is the simplest system. When a cone of light passes thru an aperture and is intercepted on a screen, the image on the screen is not clearly defined because the object point is represented on the screen by an image area. The lack of definition and the brightness of the image on the screen increase with the size of the aperture, and in the same ratio. The accompanying figure taken from Derr, illustrates this point.

In the figure *A* forms a circle if the pin-hole is circular, and being less distinct than *a*, forms what is called a Circle of Confusion on the screen *M*. If this receiving screen, or the retina, is moved further from the pin-hole to *N*, the Circle of Confusion is enlarged, but at the same time the image is enlarged also, so that the relative sharpness remains unaffected.

The distance of the pin-hole from the eye makes little difference within certain limits, but the brightness of the picture varies inversely as the square of the distance between the pin-hole and the image, and directly with the area of the hole. It is a theorem of physical optics that the maximum concentration of light at the center of the image is obtained when the axial and marginal rays coming thru the hole differ in length by one-half the wave length of the light employed. This theorem may be used theoretically to determine the best diameter of the pin-hole, when the wave length of the light is known. Doubling the distance between the pin-hole and the retina requires that the area of the hole be twice as large to produce as clear an image, but then the image on the retina will cover four times the area. In photography this would mean that twice the time of exposure would be required to produce the maximum distinctness.

Sheard states that "the variations of the size of the pupil exercise two effects, which are opposed to one another, upon the visual acuity. The pupillary dilatation increases the visual acuity in that it reinforces the luminous intensity of the retinal images; but, by virtue of its participation in the formation of these images in the eccentric portions of the retina, it diminishes their sharpness, and therefore reduces the acuity."

Bourdier in a series of experiments, determined the visual acuity with various sized pupils, the apparent diameter of which he measured with the aid of instantaneous photography.

Broca's investigations revealed that contraction of the pupil and resulting loss of illumination were caused by placing lights of varying intensity in the direct field.

Cobb has recently published the results of some investigations upon the influence of pupillary diameter upon visual acuity. He concludes that "an aperture for optimal visual acuity exists somewhere between the limits of 1 mm. and 5.6 mm. for brightness of test object between 5.9 and 189 candles per sq. meter." And that "the optimal pupil corresponds on the whole with the size of the pupil accepted as normal for all except extreme conditions, from 2.8 to 4 mm."

In concluding Sheard states that "the investigations show quite clearly that eyes having equality of functions and structure in all particulars, and yet varying widely in pupillary area, will have appreciable acuity differences."

Taking the above mentioned investigations as a foundation, and bearing in mind the conclusions arrived at by other investigations, I have attempted to make a study of the effect of various sizes of artificial pupils upon the visual acuity, with the eyes at rest under the influence of homatropin and cocain. In the first series of thirteen cases, the same test object was used for all, the illiterate test numbers of Dr. Edgar J. George, and under the same conditions of illumination. The card was placed at a distance of 5 meters. My tabulated results are shown in the accompanying tables.

For making this little experiment I have devised a revolving disc perforated with the various sized apertures, which is fastened eccentrically upon an opaque disc which has a central aperture of larger diameter than the rest, and rests in the trial frame approximately 2 cm. from the patient's eye.

Summing up the information obtained by the first series of experiments as shown in Table I, we can draw the following conclusions: First, when the vision of an eye is impaired as a result of imperfect focussing, there being no organic disease or disease of the nervous mechanism, the vision can be very markedly improved by the use of a pin-hole disc of the appropriate diameter. Second, when the ciliary muscle is paralyzed, the size of the apertures which give the most acute vision for objects at 5 meters distance, ranges between .939 mm. and 1.75 mm. in diameter, the aperture 1.32 mm. in diameter giving most frequently the best vision.

In the second and shorter series of experiments an attempt has been made, with the pupils of the eyes fully dilated, to discover the influence produced upon the acuity of vision when the aperture of the artificial pupil was 2 mm., 4 mm., 6 mm., and 8 mm., the latter being approximately the diameter of the average fully dilated pupil. The results may be found in Table II. In general it may be stated that my findings with these larger artificial apertures prove that errors in vision due to imperfect focussing of eyes are not materially affected, and certainly the vision is not materially improved by 6 and 8 mm. openings; that the 4 mm. opening helps only slightly, and that the 2 mm. opening is the best of the four sizes. It also proves that the findings of the first series must be approximately correct, and that an artificial pupil of less than 2 mm. in diameter will give the greatest acuity of vision. It seemed unnecessary to try out these larger openings on more cases, for there was no indication that any difference would result in the findings, or that the conclusions would in any way be altered.

TABLE I.

Table I. Details of vision in twenty-six eyes with apertures of diameters ranging from 0.254 to 4. mm.

| Patient No. | Age | VISION Uncorrected | Under Cyclop. | Corrected | CORRECTION | 1 .254 | 2 .381 | 3 .508 | 4 .609 | 5 .762 | 6 .838 | 7 .914 | 8 .922 | 9 .939 | 10 1.14 | 11 1.32 | 12 1.75 | 13 2.50 | 14 4.00 | Best Vision with |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Vision obtained with Various Diameters of Apertures. | | | | | | | | | | | | | | |
| 1 | 19 | R. 5/6-1 | 5/20 | 5/4 | +1.25 s ⊂ +.12 c ax 180° | 5/15 | 5/12-1 | 5/10 | 5/7²-3 | | 5/7²-1 | 5/7² | 5/7² | 5/6-2 | 5/6-1 | 5/6-1 | | | | 10 with |
| | | L. 5/7²-1 | 5/20 | 5/4 | +1.25 s ⊂ +.37 c ax 165° | 5/20 | 5/15+ | 5/10-1 | 5/7²-2 | | 5/7²-3 | 5/7²-1 | 5/7²-1 | 5/6-1 | 5/6-1 | 5/6-1 | | | | - - - |
| 2 | 27 | R. 5/10+ | 5/30 | 5/6+ | +.62 s ⊂ +.50 c ax 130° | 5/60 | 5/20 | 5/15 | 5/12-1 | | 5/10-1 | 5/10+ | 5/7²-1 | 5/7²-1 | 5/7²+1 | 5/6-2 | | | | 11 |
| | | L. 5/7²+ | 5/30 | 5/5 | +.87 s ⊂ +.50 c ax 70° | 5/60 | 5/20+ | 5/12-2 | 5/10 | | 5/10+ | 5/10+ | 5/10+ | 5/7²-3 | 5/7²+1 | 5/7²+2 | | | | 11 |
| 3 | 25 | R. 5/10-2 | 5/20 | 5/5+1 | +.62 s ⊂ -.87 c ax 10° | 5/30 | 5/20-1 | 5/12+ | 5/10 | | 5/7²- | 5/7²-2 | 5/7² | 5/6-2 | 5/6 | 5/6+ | | | | 11 |
| | | L. 5/7²- | 5/12+ | 5/5-1 | +.75 cyl ax 90° | 5/30 | 5/20+ | 5/12 | 5/10+ | | 5/7²- | 5/7²+1 | 5/6-1 | 5/6-1 | 5/6+2 | 5/6+3 | | | | 11 |
| 4 | 17 | R. 5/20-1 | 5/12+ | 5/4-2 | -.75 s ⊂ -.50 c ax 20° | — | 5/20- | 5/12+ | 5/10 | 5/7²-1 | 5/7²-1 | 5/7²-1 | 5/7² | 5/6 | 5/5-1 | 5/5-1 | 5/5-1 | 5/6-1 | 5/10 | 10 & 12 |
| | | L. 5/10-1 | 5/10+ | 5/4-2 | -.50 s ⊂ -.62 c ax 166° | — | 5/15 | 5/10- | 5/10-1 | 5/10 | 5/7²-1 | 5/7²-1 | 5/6 | 5/6 | 5/5-1 | 5/5-1 | 5/5-1 | 5/6-2 | 5/6-1 | - - - |
| 5 | 38 | R. 5/7²- | 5/10- | 5/6+ | +.25 s ⊂ -.87 c ax 5° | 5/60 | 5/20 | 5/12-1 | 5/10-2 | 5/10+ | 5/10+ | 5/7²-1 | 5/7²-1 | 5/7²2 | 5/6-1 | 5/6 | 5/5- | 5/6-1 | 5/7²-2 | 12 |
| | | L. 5/12-2 | 5/10- | 5/5-1 | +.25 s ⊂ -1.00 c ax 170° | 5/30+1 | 5/20 | 5/20 | 5/12-1 | 5/10-2 | 5/10-2 | 5/10-2 | 5/10-2 | 5/7²-2 | 5/6-1 | 5/6-1 | 5/5-2 | 5/6- | 5/6-1 | 12 |
| 6 | 22 | R. 5/6-1 | 5/10 | 5/5- | -1.12 cyl ax 73° | 5/60 | 5/20 | 5/15 | 5/12 | 5/10 | 5/10+ | 5/7²-1 | 5/7²-1 | 5/7²-2 | 5/7²-3 | 5/7²-1 | 5/7²+ | 5/7² | 5/10- | 12 |
| | | L. 5/6 | 5/6 | 5/6 | -.25 cyl ax 95° | 5/30 | 5/15-1 | 5/12 | 5/10 | 5/7² | 5/7² | 5/7²+ | 5/7²+ | 5/6-2 | 5/6-1 | 5/6 | 5/5-2 | 5/4-1 | 5/4-2 | 13 |
| 7 | 24 | R. 5/4-2 | 5/20 | 5/4-2 | +1.sph | 5/60 | 5/15+ | 5/10- | 5/10+ | 5/7²-1 | 5/7²-1 | 5/6-1 | 5/6-1 | 5/6-2 | 5/6-1 | 5/6+ | 5/6-2 | 5/7² | 5/10 | 11 |
| | | L. 5/4-2 | 5/20 | 5/4-1 | +1.25 sph | 5/30 | 5/15 | 5/12- | 5/10 | 5/10 | 5/10+ | 5/7²-2 | 5/7²-2 | 5/7²- | 5/7²+1 | 5/6-1 | 5/7²- | 5/10- | 5/20 | 11 |
| 8 | 43 | R. 5/6- | 5/20 | 5/10+ | +1.12 s ⊂ +.50 c ax 70° | 5/30 | 5/20 | 5/12-2 | 5/10-1 | 5/10+ | 5/10+ | 5/10+ | 5/10+ | 5/7²- | 5/7²-1 | 5/7²- | 5/10+ | 5/15+ | 5/15- | 9 & 11 |
| | | L. 5/7²-2 | 5/10+ | 5/10-1 | +1.00 s ⊂ +.62 c ax 105° | 5/60 | 5/20 | 5/15-1 | 5/15+ | 5/12+ | 5/12 | 5/10 | 5/10 | 5/10 | 5/10 | 5/10 | 5/10 | 5/12-2 | 5/20+ | 9 & 12 |
| 9 | 27 | R. 5/5-1 | 5/30 | 5/4 | +1.25 s ⊂ +.37 cyl ax 35° | 5/60 | 5/20+ | 5/12 | 5/10-2 | 5/10 | 5/10+ | 5/7²- | 5/6-3 | 5/6-3 | 5/6-2 | 5/6-2 | 5/10- | 5/10-1 | 5/15 | 10 + 11 |
| | | L. 5/10-1 | 5/20-1 | 5/4 | +1.00 s ⊂ +.87 c ax 130° | 5/12-1 | 5/12 | 5/10-1 | 5/7²- | 5/7+ | 5/6-2 | 5/6-2 | 5/6-2 | 5/6-2 | 5/6-2 | 5/6-1 | 5/7²- | 5/7²- | 5/10 | 11 |
| 10 | 30 | R. 5/5 | 5/20 | 5/5+ | +1.25 s ⊂ +.50 c ax 90° | 5/20 | 5/15 | 5/12-2 | 5/10-1 | 5/10 | 5/7²-1 | 5/7²-1 | 5/7²- | 5/7²+3 | 5/6-3 | 5/6-3 | 5/7²-2 | 5/10-2 | 5/12+ | 10 & 11 |
| | | L. 5/5-1 | 5/20+ | 5/5+ | +1.25 s ⊂ +.50 c ax 90° | 5/30-1 | 5/30-1 | 5/15 | 5/12+ | 5/10-1 | 5/7²-3 | 5/7²-1 | 5/7²-2 | 5/7²+ | 5/6-2 | 5/6-2 | 5/6-3 | 5/10-1 | 5/15+ | " " |
| 11 | 18 | R. 5/20 | 5/20 | 5/5- | -4.25 s ⊂ -.50 c ax 90° | 5/20-1 | 5/20 | 5/15 | 5/12-1 | 6/10-2 | 6/12-1 | 5/12-3 | 5/12-3 | 5/15-2 | 5/20+ | 5/20-1 | 5/30+ | 5/60 | 5/60 | 5 |
| | | L. 5/30 | 5/30 | 5/5- | -2.25 s ⊂ -.37 c ax 80° | 5/20-1 | 5/15-1 | 5/12 | 5/10-1 | 5/10-1 | 5/10 | 5/10-3 | 6/10 | 5/10 | 5/12+ | 5/15+ | 5/15 | 5/20 | 5/30+ | 9 |
| 12 | 14 | R. 5/15+ | 5/15- | 5/5-2 | -1.25 s ⊂ -.62 c ax 82° | 5/30 | 5/15- | 5/12+ | 5/10-1 | 5/10+ | 5/10+ | 6/10-1 | 5/10-1 | 5/10- | 5/7²+2 | 5/7²+2 | 5/10 | 5/12 | 5/15 | 10 & 11 |
| | | L. 5/30+ | 5/30+ | 5/5-1 | -1.75 s ⊂ -.50 c ax 170° | 5/30 | 5/20 | 5/15 | 5/12-1 | 6/12-1 | 5/10-1 | 6/12-1 | 5/10-2 | 5/10-2 | 5/7²-2 | 5/7²- | 5/12-1 | 5/15 | 5/20- | 10 & 11 |
| 13 | 24 | R. 5/5-1 | 6/20 | 5/5-1 | +.62 s ⊂ +.25 c ax 15° | 5/30 | 5/20 | 5/15 | 5/6 | 5/10-1 | 5/10+ | 5/7²-2 | 5/7²-2 | 5/7²-2 | 5/7²-1 | 5/7²+1 | 5/6-2 | 5/7²-1 | 5/10 | 12 |
| | | L. 5/5-1 | 5/15 | 5/5-1 | +.50 s ⊂ +.25 c ax 100° | 6/20 | 5/15-1 | 5/12-1 | 5/10- | 5/10+ | 5/7²- | 6/7² | 5/6-1 | 5/6-1 | 5/6 | 5/6- | 5/6-1 | 5/7²-1 | 5/10 | 11 |

In addition to these experiments several cases were tried in which the eyes were made approximately 1 diopter hypermetropic and 1 diopter myopic, by the use of lenses placed in the trial frame. Naturally the vision was reduced by the addition of these lenses to eyes which were normally emmetropic; but in neither of the artificially farsighted or nearsighted eyes was any marked improvement in vision secured by any of these four sizes of artificial pupils. However, under both conditions the best size was the 2 mm. I believe that when the artificial pupils of greater diameter than 2 mm. are placed before the eye, the difference in distinctness and the acuteness of vision is so little altered, that the patient's answers are very uncertain and unreliable.

In making these experiments it was quite important to have the larger artificial pupil properly centered, for it was found that errors in centering produced noticeable differences in the findings. Movement of the patient's head out of position produced a similar effect. With the large aperture eccentric, the vision seemed to be somewhat improved, the effect approaching that of the smaller pupil, but when the small aperture was placed in front of the margin of the dilated pupil the vision was greatly reduced, and the patient was inclined to shift the head in such a way as to get it in the line of central vision.

The foregoing experiments were all made under the same conditions as regards the illumination of the test object, the card being illuminated with as bright a light as was possible. A few tests were next carried out to determine what effect the reduction in the luminosity of the test card might produce on the visual acuity, also to determine the relationship between the luminosity of the test object and the size of the artificial pupil required to obtain the maximum vision. In these tests the pupils were dilated with homatropin and cocain, and the eyes made as nearly emmetropic as possible with lenses. The results may be found in Table IV. The reduction in the luminosity naturally reduced the acuity of vision, both with and without correction, but it was found that when the luminosity was the best, the

TABLE II.

| Patient No. | Age | Vision Uncorrected | Vision Under Cyclop. | Vision Corrected | Correction. | Vision with Various Apertures. 2 mm. | 4 mm. | 6 mm. | 8 mm. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 31 | Right 5/20—1<br>Left 5/10—1 | 5/20+<br>5/10 | 5/5+<br>5/5+ | —1.00 sph. ⌒ + .37 cy ax 5°<br>—.75 sph. | 5/7²<br>5/6—1 | 5/10—1<br>5/10+ | 5/12+<br>5/12—1 | 5/15+<br>5/12—1 |
| 2 | 24 | Right 5/6—1<br>Left 5/7²—1 | 5/7²-1<br>5/7²-3 | 5/6+<br>5/6+ | —.62 cyl ax 178°<br>—.75 cyl ax 180° | 5/6—1<br>5/6—2 | 5/7²-1<br>5/7²-2 | 5/7²-1<br>5/7²-3 | 5/7²-2<br>5/7²-3 |
| 3 | 21 | Right 5/5—1<br>Left 5/5—1 | 5/12<br>5/12 | 5/5<br>5/5 | +1.00 sph.<br>+1.00 sph. | 5/7²-1<br>5/7² | 5/10<br>5/10—1 | 5/10—1<br>5/12—1 | 5/15—1<br>5/12—1 |
| 4 | 28 | Right 5/6+<br>Left 5/20 | 5/15+<br>5/20 | 5/4<br>5/20 | +.75 sph. ⌒ + .25 cyl ax 90°<br>No improvement—Atrophy. | 5/6—1 | 5/7² | 5/10—2 | 5/12+ |
| 5 | 25 | Right 5/7²—1<br>Left 5/10—1 | 5/12<br>5/60-1 | 5/4<br>5/6+ | +.25 sph ≷ + 1.00 cyl ax 88°<br>+1.75 sph ⌣ +.87 cyl ax 120° | 5/6+5<br>5/15—1 | 5/7²<br>5/15—1 | 5/12—2<br>5/30+ | 5/12—2<br>5/30+ |
| 6 | 23 | Right 5/5—1<br>Left 5/5—2 | 5/6<br>5/6 -¹ | 5/4<br>5/4 | —1. cyl ax 5°<br>— .50 cyl ax 170° | 5/6<br>5/6 | 5/6+<br>5/5—2 | 5/5<br>5/6+ | 5/5—1<br>5/6+ |

TABLE III.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| with —1.00 sph added | Right<br>Left | 5/10—3<br>5/10— | | 5/7²<br>5/10—1 | 5/7²—2<br>5/10+ | 5/10—1<br>5/10—1 | 5/10—3<br>5/10+ |
| with +1.00 sph added | Right<br>Left | 5/20+<br>5/20— | | 5/6—1<br>5/6—2 | 5/7²—1<br>5/7² | 5/7²—1<br>5/12+ | 5/10—1<br>5/15+ |
| with —1.00 sph added | Left | 5/20 | | 5/12 | 5/20+ | 5/20 | 5/20 |
| with +1.00 sph added | Left | 5/7² | | 5/10—1 | 5/10—2 | 5/10—2 | 5/10 |

best vision was obtained with the smaller artificial pupil, 2 mm., and the poorest vision with the largest artificial pupil, 8 mm., while when the light was reduced materially, the best vision was obtained with the largest pupil, and the poorest vision with the smallest pupil.

TABLE IV.

| | | | Vision under Cycloplegia | Vision 2 mm | With Various Apertures 4 mm | 6 mm | 8 mm |
|---|---|---|---|---|---|---|---|
| 1 | Uncorrected | With Good Light | R. 5/15-1<br>L. 5/10-2 | 5/7²+1<br>5/6-2 | 5/7²-3<br>5/7²-3 | 5/10-1<br>5/10-2 | 5/10<br>5/10-2 |
| | | With Poor Light | R. 5/20<br>L. 5/12- | 5/30+<br>5/12- | 5/20<br>5/15-2 | 5/15-1<br>5/15 | 5/15+<br>5/12- |
| | With Correction | With Good Light | R. 5/5-2<br>L. 5/4-1 | 5/4<br>5/4 | 5/4-4<br>5/4 | 5/5<br>5/4 | 5/5-3<br>5/4-1 |
| | | With Poor Light | R. 5/7²<br>L. 5/6-1 | 5/20<br>5/15 | 5/10-1<br>5/7²-1 | 5/10-1<br>5/7²+ | 5/7²-1<br>5/6-1 |
| | | | | | | | |
| | | | | | | | |
| 2 | Uncorrected | With Good Light | R. 5/20<br>L. 5/7² | 5/10+<br>5/5-1 | 5/10<br>5/6-1 | 5/10-4<br>5/7² | 5/12<br>5/10 |
| | | With Poor Light | R. 5/15-<br>L. 5/6- | 5/20-<br>5/10-3 | 5/15-2<br>5/7²+ | 5/12-3<br>5/6-1 | 5/15-<br>5/6-1 |
| | With Correction | With Good Light | R. 5/7²+<br>L. 5/4-1 | 5/6-4<br>5/4 | 5/7²<br>5/4+ | 5/7²-2<br>5/5+ | 5/7²-2<br>5/5 |
| | | With Poor Light | R 5/10-<br>L. 5/5- | 5/12-1<br>5/10-2 | 5/10-2<br>5/6 | 5/10-1<br>6/6-1 | 5/10<br>5/5-1 |
| | | | | | | | |

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# THE USE OF RADIUM IN CATARACT.

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This is a report from the Division of Ophthalmology, Stanford University Medical School, of a study made in connection with the Department of Radiology. Previous literature is cited. The method of application is given in detail and the conclusions stated which seem to be justified by the trials made upon a series of 25 cases.

The therapeutic value of radium in diseases of the eye, especially in the treatment of cataract, is still a mooted question, but a review of the literature and the cases treated by radium in the clinic, force certain conclusions which we believe are of value.

Koster of Holland, who evidently made a thoro study of the subject stated, "The progression of the cataract very often stopped under the treatment, but this is also seen when the disease is healed by mercury or in any other way. This does not show, therefore, a direct influence of the radium on the diseased lens. As for the action on the opacities in the lens, I could not see any change in the shape, or diminishing of the proportion, only in case of one patient I saw a cataract of star form on the anterior cortex fall to pieces and totally disappear after five sittings of one hour weekly."

He further states, "By my experience it becomes probable that we cannot entertain the hope that a developed cataract can become clear again, or can be resolved under the influence of the rays."

Jonquieres, who has treated many cases of epithelioma of the lids with massive doses, states that the eye shows enormous tolerance to radium and that in no case could he detect any visible changes in the structures of the eye.

The use of radium in sarcoma, glioma, epithelioma, rodent ulcer and such conditions is another question, but Janeway and also Lawson and Davidson, who have treated the above conditions with radium, found the tolerance of the eye to massive doses as reported by Jonquieres.

Cohen and Levin studied twenty-four cases and claim some improvement in eighty-seven and five tenths per cent; these changes occurred in the first few weeks, then the opacities remained stationary. They conclude that the application of radium is harmless, that there is a diminution of the lenticular opacification, and that should a cataractous lens become matured subsequently and an operation required, no difficulty will present itself.

Franklin and Cordes claim similar results and their method of application is not unlike that used here. Their conclusions were as follows:

1. The application of radium does no injury to the normal structures.
2. It apparently has a selective action upon the lens.
3. Radium improved the vision in 84.5 per cent of the cases.
4. A consistent technic and known dosage seems advisable.
5. Frequent treatments are necessary in the beginning.

There are several descriptions of radium applicators for the treatment of cataracts but literature on the results obtained is very meager.

The experiments with radium here reported were conducted jointly by the Departments of Ophthalmology and Radiology. The procedure was as follows:—A careful examination was made of the lens opacity, vision and fundus, when possible, and cessation of all other treatment during the application of the radium. A dosage of ten milligram hours applied twice a week for eight treatments followed by an examination as above described. The same dosage was then applied once a week for eight treatments and then every two weeks. This was then cut down to a treatment every four weeks, an examination being made after each series of eight treatments.

The radium was contained in a silver tube one millimeter in thickness which effectually screens out all damaging

rays. This tube was inserted into a lead cylinder lined with aluminum in order to protect the surrounding tissues, the whole being inserted in a fiber block. The open end being one centimeter from the cornea was held there by the fiber block which was adapted to the orbit. In this manner the rays were directed into the lens thru the dilated pupil.

In view of the fact that cataracts show spontaneous improvement, and, in a few rare cases disappear completely, the slight changes following radium treatment must be regarded with some suspicion and in none of the cases treated here has there been a lasting improvement. Many cases claim their vision has improved but, on examination, the opposite has been definitely demonstrated, while others in whom a slight improvement was found, could be accounted for by the individual training and stimulation of interest in the examination.

Apparent improvement occurs not infrequently during the normal development of an untreated cataract, but in this series of twenty-five there was no case in which the lens showed any improvement and several of these cases went on to maturity and operation without any influence on the lens or the vision; so our results are not encouraging.

A study of the pathology of cataract would indicate that if radium had any effect on the opacities it should increase the opacity rather than diminish it, but we have not been able to demonstrate that it had any effect either in increasing or decreasing the density of the opacity.

The application of radium caused no apparent injury to any of the structures of the eye except for an occasional erythema and slight irritability of the lids, but we could not discover any selective action on the lens or its opacities, or any changes which would interfere with a subsequent operation.

## CONCLUSIONS.

1. The use of radium as a therapeutic agent in the treatment of cataract has very little value.
2. The application of radium under known dosage according to the described technic is harmless and the effects practically nil, except for occasional photophobia, erythema and irritability.
3. As Koster has stated, a developed cataract cannot be made to clear.
4. There was no apparent diminution of lenticular opacities, nor was it possible to find any evidence of selective action on the lens.
5. The application of radium does not interfere with a subsequent operation should one be indicated.

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# TREATMENT OF CARCINOMA OF THE CONJUNCTIVA WITH RADIUM.

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This method has to be compared with the operative treatment. The clinical and the microscopic diagnosis and etiology are discussed. Details regarding the treatment are given and a series of case reports with comments follows. A summary of the deductions arrived at is given. This report comes from the general service of the Memorial Hospital under Dr. Douglas Quick, Attending Surgeon.

The encouraging results that have been obtained at the Memorial Hospital in the treatment of a small series of conjunctival carcinomas, has prompted the writer to review the disease, and to emphasize the advantage of radium therapy.

Wickham and Degrais[1] were probably the first to use radium as a curative agent in this type of growth. The pioneer in America is Collins[2], who in 1915 treated one case with success. Wessely[3], in 1919, obtained a clinical regression with mesothorium, and New and Benedict[4], in 1920, reported two cases of epithelioma of the limbus which were controlled satisfactorily. Albers-Schönberg[5], in 1920, as others had done before, used a physical agent in the form of X-ray. With these exceptions the treatment of choice has been local excision of the growth with basal cauterization, and in advanced cases, enucleation or exenteration.

An essential aid to the radiation therapy of any tumor, is a correct appreciation of the extent of involvement, by means of inspection, palpation or other method of investigation. In conjunctival carcinoma, such an estimation is comparatively easy. Most cases, when first seen, are obviously limited to the tissue of origin, and only in the late stages is the anterior chamber penetrated. De Schweinitz and Shumway[6] stated that perforation has occurred in 37.6 per cent of eyes removed at operation. However, this proportion is relatively too high, because it includes only the very advanced neoplasms which demanded radical treatment. By others, perforation is considered a rare occurrence, and confined to matured and badly treated cases. (Axenfeld[7], Wintersteiner[8], Greeff[9].) It is evident, therefore, that the cornea and sclera offer a considerable resistance to invasion, especially if Bowman's membrane is uninjured by surgical trauma.

There is uniform agreement on the frequency with which the growth arises in the very vascular limbus conjunctivae (Saemisch[10], Heilbrun[11]), and more frequently in the nasal, than in the temporal portion (Licskó[12]). It is thru the limbus, that penetration of the globe most commonly commences. The oldest portion of the tumor is at this point, and the lymphatic channels surrounding the anterior ciliary vessels are natural paths of communication.

## CLINICAL DIAGNOSIS.

The recognition of the disease usually offers little difficulty, altho Lagrange[13] in a historical note, refers to the fact that for many years there was confusion with analogous lesions, and terms such as "vicious fungus" and "excrescences of flesh" were used. He has described a very early case, that presented itself as a minute ulcerated phlyctenule which, during repeated cauterization, grew slowly to assume its mature character. A fully developed lesion may be no larger than a small pea, and is always situated on the external surface of the membrane (Panas[14]). During its further growth, which is usually a surface extension, it may attain a size sufficient to push the eyelids far apart, and appear between, as a greyish red, finely nodular mass, often blackened by hemorrhage. With large cancers, the surface is always much greater than the base. Many are therefore distinctly pedunculated, and overhang a considerable area of sclera and cornea. Ulceration may develop; a thin slough then covers the surface. Ordinarily the growth is single, but distinct lobes may be distinguished. Slight bloody discharges are caused by irritation. True hemorrhages are rare.

As has been mentioned, the tumor more often arises from the limbus than from any other portion of the globe. A few spring from the palpebral conjunc-

tiva, and secondarily spread to the sclera. A peribulbar type is recognized, which extends completely around the cornea in an annular fashion (Heyder[15]). Visual disturbances mechanically appear when the pupillary area is covered.

Lagrange[13] has studied in detail the direction of cellular growth during the process of perforation. He describes in classical language the advance of cell columns thru lymphatic channels. Schlemm's canal is the objective. When this is occupied, younger and more vigorous cells enter the anterior chamber and, with all resistance killed, involve finally intrinsic and extrinsic orbital structures. Saemisch[10] makes the interesting observation, which is not unknown in other fields of oncology, that a preliminary inflammation in the uveal tract, may precede actual tumor ingrowth.

The occurrence of metastatic deposits is infrequent. Profeta[16] has tabulated 54 cases, in 3 of which regional lymph glands were involved, 5.5 per cent. The preauricular glands are first affected, and the submaxillary group later. (Parsons[17]).

The rate of growth of carcinoma of the conjunctiva is by no means uniform and constant. For a long period the neoplasm may barely show an increase in volume, and then suddenly, often under stress of trauma, flare up and destroy at a very rapid rate.

MICROSCOPIC DIAGNOSIS.

During its passage from the free edge of the eyelid to the cornea, the character of the conjunctival epithelium changes in different parts of the sac. Thus at the border of the lids, and for a few millimeters over the tarsi, it resembles the epidermis in being stratified squamous. Towards the fornices, and passing on to the sclera, a somewhat altered stratified type is found, consisting of four or five layers of cells, the deeper of which are small and spheroidal, and the superficial elongated or conical. The latter, however, may be somewhat flattened, in which case, they resemble closely stratified squamous epithelium. Near the margin of the cornea, another transformation occurs, and the superficial cells become progressively flattened, thereby conforming to the stratified squamous type, which is regularly found close to the palpebral margin. It is this normal variation that produces confusion in the terminology of the epithelial tumors arising in the conjunctiva. For the sake of clarity and uniformity, Ewing's[18] classification of epidermoid carcinoma of the skin might well be used.

The following groups would be recognized:

1. Acanthoma—characterized by the presence of adult squamous cells, pearl formation and cornification. Such cases are reported in detail by Saemisch[10] and de Schweinitz[6]. A pavement cell epithelioma is described by Lagrange[13], in which the cells are large and grouped in columns, with no pearl formation. It is an acanthoma with recessive adult characters.

There are two main types of acanthoma which give very different clinical pictures.

(a) For many, a distinct papillomatous stage is recognized. (Freytag[19], Rutschmann[20], Pasetti[21]). They are not ulcerated originally, and advance slowly, but influenced by irritation the growth is active and involvement of the layers of sclera and cornea occurs. Such papillary growths may be multiple (Luedde[22]). Contino[23] describes two types, depending on the predominance of epithelial, or connective tissue elements. As instances of the clinically benign course of papillary tumors, Licskó[12] cites three cases in which the growth had been present for 10 years, and in one instance for 32 years. Cases Nos. 1, 3, 5, and 7 of our series were clinically of this type.

(b) Other acanthomas grow rapidly, ulcerate early, and have no distinct papillary stage. They recur promptly after local removal, and metastases may supervene. The entire loss of adult epithelial character may give to the tumor an indifferent or round cell appearance, which leads to the diagnosis of sarcoma (Saemisch[10]). Cases Nos. 2, 4 and 6 belong to this group.

2. Basal Cell Carcinoma. This is undoubtedly a rare tumor, and cannot be distinguished clinically from acanthoma. Cases have been reported by Krom-

pecher[24] and Coover[25]. Licskó[12], who has studied this type, states that the histology is not different from basal cell carcinoma elsewhere. They recur frequently after operation, but as an evidence of their relative benignity more permanent cures are obtained with this type than with acanthoma. An adenoid type is reported by Bohm[26], and probably arose from the glands of Krause or Henle, close to the fornix. Our records contain no cases of this variety of tumor.

ETIOLOGY.

There seems to be no great difference in the incidence of the disease between the sexes. It is an affliction that seldom appears before the fifth decade, altho Heilbrun[11] cites a case in a child of five following a lime burn, and Greeff[27] in a child of six as a sequel of xeroderma pigmentosum. In seven cases collected by Rogman[28], the ages ranged from 20 months to 37 years. The youngest case in our series is a girl of 13 years, and the oldest a woman of 84 years.

Many possible etiologic factors have been described—a pterygium (Wiener and Alt[29]), a nevus (Offret[30]), a dermoid (Duclos[31]), an inflammatory epithelial overgrowth (Höhne[32]). A contact cancer from the lower lid has been noted on the cornea (Eymann[33]). One of our cases, No. 7, gave a definite history of injury by a particle of steel 2 years before the development of a tumor.

Saemisch[10] enumerates three reasons why the limbus is the site of predilection:

1. Epithelial transformation occurs at this point.
2. A liberal blood supply.
3. The presence of occasional normal irregularities in the development of the epithelial layer in the form of invaginated processes.

TREATMENT.

For the treatment of lesions of the conjunctiva, we have taken advantage of the large amount of emanation that is produced daily at the hospital, about 600 millicuries. Ordinarily it is collected in capillary glass tubes which are used in many ways. But once in three weeks, a day's supply is gathered in a small glass bulb[34] measuring about 5 millimeters in diameter. This is sealed with paraffin in a steel cone, that surrounds the bulb on all sides except one. A flexible wire handle is attached to facilitate manipulation. One side of the bulb, therefore, emits unfiltered rays, which are made effective by simply holding the applicator against the lesion.

Dosage is entirely regulated by individual cases. As a rule, 250 millicurie minutes will cause complete regression of tumor tissue 3 millimeters thick, over an area of 0.7 square centimeters. It has been our custom to treat about 4 areas at one time. Three weeks are allowed to elapse before completing the radiation. The first noticeable effect occurs in about 8 days, with the appearance of a slight conjunctival inflammation. The growth gradually dissipates in a very remarkable fashion, and in 3 to 4 weeks has completely regressed. There is no more convincing example of the selective action of radium for certain types of tumor formation. If the dosage has been correctly estimated, there is no gross tissue destruction, and consequently no subsequent scarring. In none of our cases have metastases occurred, and we have not considered the prophylactic radiation of gland bearing areas. It would appear that the production of metastatic foci is in a large measure dependent upon curettage, cauterization, or other forms of surgical injury. It is undoubtedly an embolic process, and such operations would favor the loosening of malignant cells. The bulb treatment is a gentle process, and is so free of trauma, that the preliminary use of cocain is unnecessary.

CASE REPORTS.

Case 1. Female, age 25, was referred for treatment on Sept. 19, 1917. When 13 years old, a red spot appeared on the eyeball and remained stationary for ten years. It then grew quite rapidly and 2 months prior to admission was removed surgically, and proved to be acanthoma.

At the time of treatment, the recurrence measured 1x¾ cm., and was elevated 2 millimeters. It was pale pink in color, finely granular and was adherent at the limbus. There appeared to be no intraorbital extension.

*Treatment.* Two silver filtered tubes were held over the lesion, 1 millimeter distant, on four occasions, during a period of 6 months. The dosage averaged 35 millicurie hours each treatment.

*Comment.* This was the first case of this type treated at the Memorial Hospital with radium. The bulb was not yet devised. Accuracy of application was here impossible, and complete regression was obtained only after 6 months. No scarring was produced, however, and at the present time, after an interval of 6 years, there is no recurrence.

The advantage gained by the use of the bulb is two-fold: 1. It is a means of very accurate application with a short exposure period. 2. The rays are unfiltered, and therefore soft beams give the desired superficial effect before a harmful quantity of hard rays enter the orbit. The truth of the latter statement is now becoming apparent. Within the last few weeks we have learned that the lens of the radiated eye in case No. 1 is developing an opacity*, which is so unlike an ordinary cataract, that we must conclude that the amount of penetrating beta and gamma rays is an important etiologic factor. Case No. 2 is additional evidence. Dr. Arnold Knapp, consulting ophthalmologist, is now investigating this problem, in order to definitely prove or disprove the relation.

Case No. 2. Male, age 73, was referred to the clinic June 23rd, 1920, for a growth of the conjunctiva that commenced as a pink nodule about one year before. Dr. Knapp examined the case and considered it acanthoma. The tumor measured 1½x1 cm., and covered the medial half of the cornea, extending for about 1 cm. on to the sclera. It was of firm consistence, greyish-red in color, slightly ulcerated and fixed to the limbic area but not involving the anterior chamber. Vision was partially obstructed.

*Treatment.* Two silver tubes were placed 1 mm. from the lesion. A dosage of 93 millicurie hours was given. Regression was complete in six weeks.

*Comment.* Two years later there was no evidence of tumor. However, Dr. Knapp examined the patient at this time and discovered opacities in the lens and a partial optic atrophy. In six months, the vision was entirely destroyed in this eye by a well developed glaucoma, the pain of which was relieved by an operation that had no effect on vision.

Case No. 3. Male, age 39, was first observed on May 28th, 1920. His previous history was not significant. The eye lesion commenced five years before, and grew very slowly. Six weeks prior to coming to the hospital an operation was performed. There was a prompt recurrence in the scar. The lesion measured 1x0.5 cms., and overlapped the limbus on the lateral half of the eye. It was papillary in type and not ulcerated. An examination of the tissue removed at operation, showed a papillary acanthoma.

*Treatment.* One silver tube was applied for a dosage of 50 millicurie hours. Following this the patient was lost to the clinic for nearly 2 years. When next seen, on April 25th, 1922, there was a small recurrence on the cornea, close to the site of the original tumor. This was treated on two occasions with the unfiltered bulb, causing a prompt regression which has lasted for 1⅔ years. Vision is perfect.

*Comment.* In spite of careful application of the silver tube, sufficient accuracy was not obtained to produce a permanent regression. This difficulty has been obviated by the introduction of the bulb.

Case No. 4. Male, age 62. About one year before applying for treatment, a pink growth appeared on the eye. This grew so rapidly that vision was gone completely, in about eight months. Then several operations were performed, but all were unsuccessful. Microscopic diagnosis was acanthoma. Patient now (July 7th, 1921) presents a greyish-white, finely nodular tumor, measuring ½ cm. in diameter, and situated at the limbus, just medial to the cornea. There is no evidence of intraocular growth.

*Treatment.* Using the unfiltered bulb

*Bagg, working in the Memorial Hospital research laboratory, has reported on the experimental production of lenticular opacities in animals. The exposure of unborn rats to gamma rays from radium, produced also corneal opacities and total blindness. (American Journal of Anatomy, v. 30, Jan., 1922.) Strong doses of gamma rays applied over the heads of young cats, caused the formation of lenticular opacities in a period of several months. (Proceedings of the Pathological Society of Philadelphia, N. S. XXV, 1923, 48.)

a dose of 324 millicurie minutes was given over each of two areas. In six weeks the growth had disappeared, leaving a slight scar at the site of the previous operations. This patient has remained well for a period of 2½ years.

Case No. 5. Male, age 40, came for treatment August 16th, 1922, stating that a red spot had been present on the eye, as long as he was able to remember. Two unsuccessful operations were performed seven years ago. At the time of admission, the lesion was 1x2 cms. in size, and was placed on the sclera of the upper inner quadrant. It was firm, red and nodular, and gave off a blood tinged discharge. The cornea was encroached upon for a distance of 3 millimeters. This tumor was slightly pigmented in one area. The anterior chamber was not involved. Biopsy was performed before coming to the clinic. Dr. Ewing examined a section, and pronounced it acanthoma.

*Treatment.* The bulb was used on two occasions. Each treatment consisted of 400 millicurie minutes divided over two areas. There was complete regression five weeks after the second treatment. Patient has remained clinically well for 1½ years.

Case No. 6. Female, age 85, came to the hospital on May 1st, 1923, because of a growth on the conjunctiva of the right eye. This had commenced nine months before, growing slowly at first, but lately has enlarged rapidly with the appearance of superficial ulceration. The tumor measured 2x1 cms., was situated on the sclera just lateral to the cornea. It was firm and not definitely adherent. On May 4th four areas were treated with a total dose of 800 millicurie minutes. It was planned to complete the treatment in three weeks. Unfortunately, the patient at this stage went to the clinic of an Ophthalmic Hospital, where she was admitted, and on May 17th the eye was removed. On October 27th, she was again admitted because of pain in the eye socket. It was then found that there was a recurrence as large as a small hazelnut, involving the soft tissue of the orbit. On October 30th, an exenteration was performed, and a week later she was referred to the Memorial Hospital for postoperative radiation. Her recent progress has been entirely satisfactory. The tissue removed at the second operation contained acanthoma.

*Comment.* In view of the fact that this was originally a case early in growth, and favorable in expected radium response, it is a matter of great regret that the Eye Hospital surgeons saw fit to operate upon one so advanced in years. In so doing, we believe that the growth was mechanically spread to the orbital structures. The difficulties of successful radiation, thereby, have been greatly increased.

Case No. 7. Male, age 47, came under observation on August 15th, 1923. Four years before, while at work, a fragment of steel entered the right eye. The foreign body was easily removed, and no unfavorable symptoms developed. About 2½ years later, a growth appeared on the conjunctiva, which has gradually increased causing a decided interference with vision. Examination showed a red, granular, flat, slightly ulcerated neoplasm involving the entire lateral half of the sclera, and growing on the cornea for a distance of 5 millimeters. Much of the tumor was covered by the upper eyelid, and was freely movable with the conjunctiva. The anterior chamber was not invaded. A minute section of tissue removed at this time was reported as papillary epidermoid carcinoma (acanthoma). The lesion was treated in two stages with the unfiltered bulb, and on November 21st, just three weeks after the last radiation, there was no clinical evidence of disease. On January 4th, 1924, we noted the absence of any gross scar tissue. The sight is now normal.

*Comment.* Most writers are agreed that in spite of the relatively benign course of untreated cases, there are distressing recurrences in countless patients after attempted surgical interference. If the cases were carefully observed during a long period after operation, the numbers would still further be increased, because most of the accounts are published a few days after healing of the wound. According to Licskó[12], recurrences appear usually within one to ten months; the earliest was noted twelve days, and the latest seven years, after operation. His mortality in 74 patients was 27 per cent.

It is the opinion of only those who believe that a carcinoma cannot reach to the deep parts that prognosis is good. Partisans of an optimistic prognosis expose themselves to an aftermath of regrets (Lagrange[13]). Recurrence occurs with extraordinary regularity. (Saemisch[10]).

Such statements coupled with individual case reports lead to one conclusion; that a slow growing, well restrained tumor is practically never removed by simple ablation, which is performed one, two, or even three times for prompt recurrences; that such operations induce with great constancy, orbital penetration, which necessitates more extensive operations, which in many instances fail to preserve life. The cases of this series are no exception. They demonstrate only too clearly the unfavorable results of operations that are practiced. The contrast with what we have accomplished with radium therapy is unmistakable.

It was fortunate that intraorbital extension in our cases was the exception and not the rule. It is inconceivable, that radiation of any type would successfully eradicate a cancer in the anterior chamber without destroying the function of the eye. A lesion of such magnitude should be treated with the hope of saving the life, and not the eye. Exenteration would be indicated, combined with preoperative and postoperative radiation.

None of the cases treated with the unfiltered bulb have developed lens opacities. It is the method of choice. The dangers of filtered radium must be recognized.

SUMMARY.

Epidermoid carcinoma of the conjunctiva is a local disease, restrained in its growth by the fibrous outer layer of the eyeball.

Surgery usually fails to cure and actually assists the local and regional spread of the disease.

Radium therapy gives promise of being a curative agent in cases not involving intrinsic ocular structures. When perforation has occurred, a combination of surgery and radium is indicated.

Evidence is accumulating which makes it appear that heavily filtered radiation may produce opacities in the lens. Unfiltered radiation is therefore the agent of choice.

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## THE PROJECTION OF RETINAL EXCITATIONS BY DIFFUSE LIGHT.

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This describes an experiment in the projection of the visual field diffusely lighted thru the closed lids by an electric lamp. In this field is a more brilliant point but this is not projected in the direction of the lamp but about 45° to the temporal side. It is suggested this projection depends on the evolution of the forward looking eye from the lateral eye of lower animals.

The following experiment is made in a dark room. One eye is completely obscured by an opaque bandage; the other eye is only kept closed, and an unlighted electric lamp is placed in front of it. For instance a frosted lamp of 16 cp. at the 0° of the perimeter.)

The eye, behind its lids, is kept looking straight ahead, towards the lamp. Every time the light is momentarily turned on, the eye perceives a very diffuse light, but showing in one place a more brilliant point. The interesting observation is that this brilliant point is not projected in the direction of the lamp, but more laterally towards the temporal side, at an angle of about 45°.

If the lamp, instead of being placed in front of the eye (still looking ahead), is displaced laterally along the perimeter to the nasal side, the impression will be still the same, and the brilliant center will be projected in the same direction as before, temporally. If the lamp is displaced towards the temple, the projection still goes to the same point, until the lamp itself comes to be placed at more than 45°; the projection seems then to be more correctly directed to the actual situation of the source of light.

If, lamp and head being kept unmoved, the eye, behind its lid, is directed towards the nose or the temple, the projection of the luminous point will still go to a direction quite different from the actual position of the lamp, and always temporal. This experiment shows that the line of projection is independent of the direction of the incident light or the sagittal plane of the head, but is oriented after the visual line, keeping, as stated above, at an angle of some 45° temporally of the latter.

More closely discussing the experiments, we see that in the first case the lamp is on the line of sight. If the eye were open both half-retinae would be equally affected. When the light is diffused by the eyelid, the sensation of the nasal half-retina prevails considerably, and the source of light is located towards the temple.

In the second case, the lamp may stand temporally as regards the visual line; it would affect the nasal part of the open eye. The projection of the closed eye goes towards the temple, as is natural. When the light comes from the nasal side of the visual line, it would affect the temporal half of the open eye. Even in that case, when the eye is closed, the projection is temporal, as before.

In the third case, when the eye is turned towards the nasal side, the lamp is in front of the nasal half of the retina, and the projection is naturally directed temporally. When the eye is directed towards the temple, the lamp is placed opposite the temporal half of the retina, and, nevertheless, the feeling is that of a source of light placed temporally. It is most surprising, when the eye is opened at that moment, to realize how largely obtuse an angle may be formed by the direction of the incident light, coming from the nasal side, and the very much

temporal direction in which the lamp was supposed to be.

The following, hypothetic conclusions may be drawn from our observations.

When, the vision of any definite image being suppressed by the closing of the lid, and the sensitiveness of the fovea considerably dulled, as is known, the retina is uniformly covered by very diffuse light the sensation that the place of the retina, where the rays coming from in front formed their images, and which was differentiated into a fovea, came to occupy more and more the center of the retinal cup. The lateral, monocular vision of the mammal was gradually replaced by binocular vision, which exists alone in man.

In ordinary life the impressions received by the nasal (crossed) part of

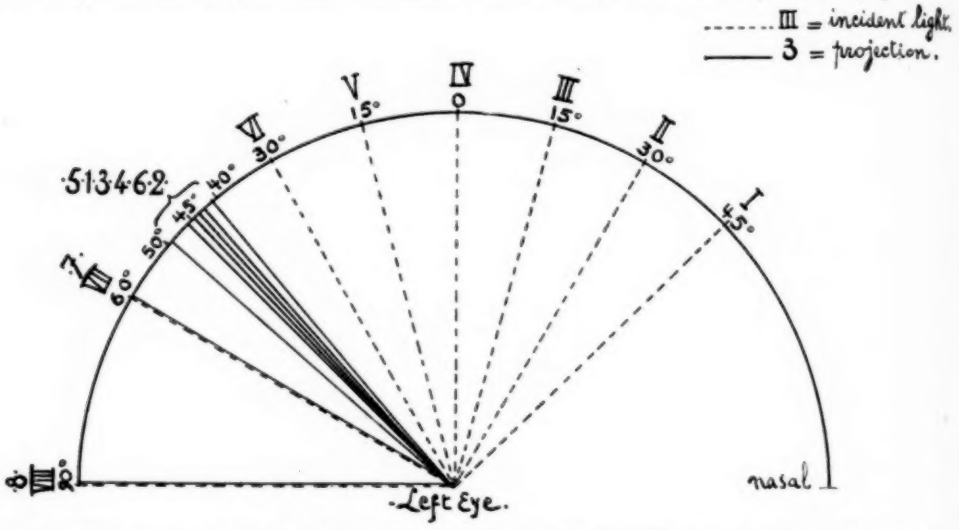


Fig. 1.—Diagram showing relations of direction of incident light to the direction in which the impression appears to come. The broken lines and Roman numerals show various positions in which the rays fall on the eye. The solid lines and the corresponding numerals in Arabic indicate the apparent direction of the source of light. Thus from III, 15° to the nasal side of fixation the light was referred to a source a little more than 45° from the line of fixation to the temporal side.

due to the nasal part of the retina, the fibers of which are crossed, completely dominates the other part with direct fibers.

From a general point of view, this seems to illustrate the fact that the nasal half-retina represents the real lateral eye; far more ancient and important than the direct bundle, which certainly appeared later in the evolution of animals.

From the more particular point of view of the evolution of man, it may perhaps throw light on a question alluded to in a former paper[1]. A study of the different axes of the human eye and of some details in anatomy (the insertion of the muscles and check ligaments, for instance, shows how the organ has left its originally lateral direction, and has rotated in such a way the retina are oriented in relation to the fovea, the images are projected with regard to the point of fixation.

(The cones are anatomically grouped around the fovea, and impose this orientation; in the dark their very strong solicitation ceases.)

It was doubtful whether, during that evolutive rotation, the center of monocular vision had finally met the center of binocular vision and coincided with it. Now our experiment seems to prove that when the nasal half of the retina is covered with diffused light, without any image to awaken conscious defined vision, uniform excitation gives a sensation that is not uniform, since it contains a point of greater brightness. This may correspond to an ancient center for lateral vision, functionally regressed, but still in its primitive place.

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# APPLICATIONS OF A FUNDAMENTAL MATHEMATICAL EQUATION TO OCULAR REFRACTION AND OPHTHALMIC LENSES.

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The formula here discussed is the one that shows the change in effect of a lens produced by changing its position with reference to another lens or the eye. This is considered with reference to the distance of a correcting lens in front of the cornea, the amount of H. or M. corrected by a given lens, at a certain distance in front of the eye; and the effect of the thickness of the lens in altering spherical or cylindrical effect, when the lenses of the trial frame are to be replaced by the combination to be worn. The paper is contributed from the Section on Physics of the Mayo Clinic.

I appreciate the fact that ophthalmologists are not interested in detailed discussions of mathematical formulas and equations pertaining to modern ophthalmic lenses, or refraction. I have, however, been asked on numerous occasions to prepare an essay which would give the essential or underlying principles involved in the determination of the effects of changing positions, curvatures and thicknesses of lenses used in testing or when worn by the person for whom they were prescribed. This paper is an attempt to establish the general applicability of a single mathematical formula to problems which are likely to be of interest and of value to the profession.

## THE FORMULA.

The fundamental formula to which reference is made is:

$C = k\ s\ D^2$ ..... equation 1

In this relation, C = change in effectivity, or in vertex power, expressed in diopters.

$k$ = a constant or multiplying factor. If the measurement of $s$ is expressed in millimeters, $k = 0.001$.

$s$ = distance in millimeters.

D = specified dioptric power of lens.

Having given the formula and having signified in general terms the meaning of the symbols used, we are applying equation 1 to several practical aspects of clinical and office practice in refraction.

## CHANGE IN EFFECTIVITY.

For the sake of clearness, it seems desirable to consider briefly what is meant by the expression "change in effectivity". The effectivity, or effective power of a convex lens, increases as such a lens is moved away from the eye, and decreases as it is brought closer to the cornea. On the other hand, the effectivity of a concave lens decreases as it is moved further from the eye, and vice versa. This will be appreciated readily thru a consideration of Figure 1.

If the plane marked *a* represents the fixed reference plane and parallel light is focussed on it by a given lens in position 1, then parallel light will be focussed in plane *b*, if the lens is moved nearer to the initial plane *a*. In the case of an eye corrected by a lens in position 1, undercorrection would obtain if the lens occupied position 2, assuming accommodation inoperative. If the lens is moved to position 3, parallel light will be focussed in plane *c*. In an eye, therefore, corrected by a given lens in position 1, overcorrection will exist if the same lens is positioned as at 3.

A similar line of reasoning can be carried out with concave lenses, in which case it will be seen that the effectivity of a concave lens decreases as it is moved away from the cornea. These effects are diagrammed in Figure 2. Since the images are virtual, and since concave lenses have the property of diverging incident light and bringing it to a virtual focus, the planes *a*, *b* and *c* must be taken in advance of, rather than behind, the plane of the cornea.

## THE EFFECT OF CHANGING THE POSITION OF A SINGLE SPHERICAL OR CYLINDRICAL LENS IN FRONT OF THE EYE.

The change in dioptric power of a lens, by reason of a linear change in position as measured from the cornea, is immediately obtained from equation 1. If, for example, a + 8.00 D. S. is moved 7 mm. farther from the eye, its increase in power is given as $0.001 \times 7 \times 8^2$, or 0.45 D. Hence the true effec-

tivity of a + 8.00 D lens is 8.45 D when this lens occupies a position 7 mm. farther away from the cornea than it originally occupied. And again, if a — 5.00 D. S. lens were found to be correct, and this lens were moved forward (away from the eye) 8 mm., the change in effectivity would be 0.20 D; hence the effectivity of the lens in its second position would be — 4.80 D.S.

We may very properly refer to the power which a spectacle lens possesses when properly mounted before an eye as its *frame power*. If, therefore, the spectacle frame does not occupy the same position as the trial case lens in the trial frame, there will be a difference in the *effective powers* of the same lens in the two cases. Or again, if the frame position is altered, there will be a change in the effective power of the lens. This change is calculated by the use of equation 1.

The foregoing point is worthy of special attention in *aphakic* cases or, in general, in either high plus or minus corrections. A change of frame position, or a difference between the position of the lens in the frame worn by the patient, as compared with the location of the trial case lens in the trial frame, produces marked effects when strong lenses are used. A displacement of 4 mm. forward from the cornea, using a + 15.00 D. S., for example, gives this + 15.00 D. S. an effective value of 15.90 or practically + 16.00 D. S. The practical result in this instance is an overcorrection of one diopter. Should this + 15.00 D. S. be moved 4 mm. nearer the cornea, the lens would have an effective value of + 14.00 D. S. and would, therefore, undercorrect the eye by nearly one diopter.

Similar considerations enter in the use of high minus lenses. The effects, however, are opposite to those rehearsed in the previous paragraph. For instance, a displacement of 4 mm. forward from the cornea, using a — 15.00 D. S. gives this lens an effective value of —14.00 D. S.

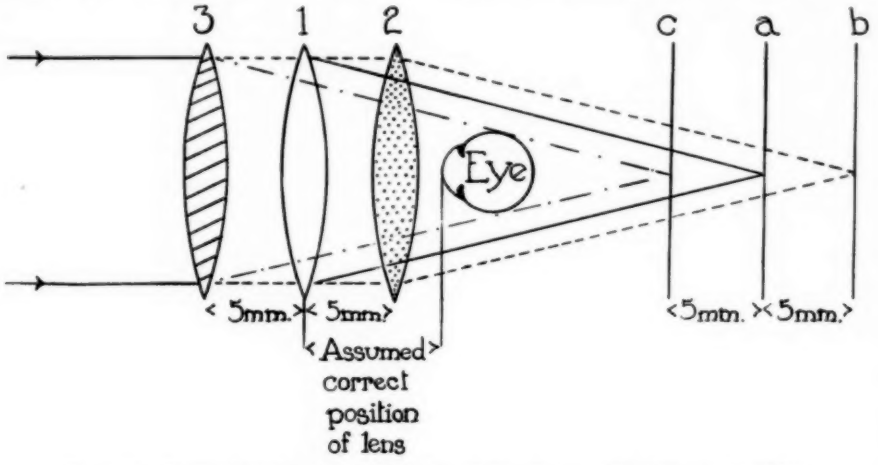


Figure 1. Illustrating change of effectivity of plus lenses with change of position.

Cylindrical lenses have effective powers which change with variation in position; these changes may be calculated by equation 1.

Table 1

EFFECT OF CHANGE OF POSITION ON EFFECTIVE POWER.

(Measured in diopters)

| Lens, simple sphere or cylinder | Distance lens moved 5 mm. | 10 mm. | 15 mm. |
|---|---|---|---|
| +2* | ±0.02 | ±0.04 | ±0.06 |
| +4 | 0.08 | 0.16 | 0.24 |
| +6 | 0.18 | 0.36 | 0.54 |
| +8 | 0.32 | 0.64 | 0.96 |
| +10 | 0.50 | 1.00 | 1.50 |
| +12 | 0.72 | 1.44 | 2.16 |
| —2** | ±0.02 | ±0.04 | ±0.06 |
| —4 | 0.08 | 0.16 | 0.24 |
| —6 | 0.18 | 0.36 | 0.54 |
| —8 | 0.32 | 0.64 | 0.96 |
| —10 | 0.50 | 1.00 | 1.50 |
| —12 | 0.72 | 1.44 | 2.16 |

*The sign + signifies the change in effectivity in the single lens quantity specified, when the lens is moved away from the cornea the distance (in mm.) indicated.

**The sign — gives the change in effectivity if the lens is moved closer to the cornea the amount (in mm.) indicated.

Table 1 gives the increase in effective power (in diopters) produced by moving the lens specified thru the distance (in millimeters) shown at the top of each of the columns respectively.

### EFFECT OF CHANGE OF POSITION OF A LENS IN THE TRIAL FRAME.

The effective, vertex or back-focal powers of the trial case lenses are those indicated by the manufacturers. Prentice, in 1898, took up the question as to why strong lenses of the biconvex and biconcave type, in which the sum of the powers of the two surfaces was equal but of opposite sign, did not neutralize. From his suggestions and computations, *all trial lenses in the standard trial case have their values indicated in effective, vertex or back* (ocular) *surface power.* If, therefore, it were physically possible to insert several trial case lenses in the same plane in the trial frame, the total effective power could be found by the simple process of addition. But trial lenses must be separated for mechanical reasons. The examiner may desire to know the exact equivalent effective power of two or more lenses in the trial frame, when made as a single lens and inserted in the cell occupied by the ocular lens (lens nearest the eye). This can be accomplished by the use of equation 1.

As an example, assume that the separation between a + 8.00 D. S. occupying the cell most remote from the eye and a + 9.00 D. S. in the ocular cell is 10 mm. We are desirous of finding the power of a lens, occupying the ocular cell, which possesses the same effective power as the 8.00 D. S. lying in a plane 10 mm. more remote from the eye. The change in effectivity of the + 8.00 D. S. is given by equation 1 as,

$$C=0.001\times10\times64=0.64 \text{ D. S.}$$

Hence the single lens needed in the ocular cell is the sum of + 8.64 D. S. and + 9.00 D. S., or + 17.64 D. S. instead of + 17.00 D. S., the indicated sum of the two lenses used. This

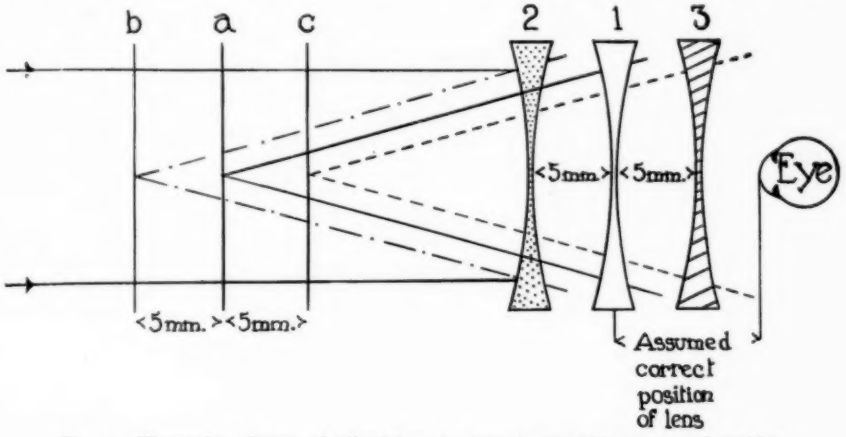


Fig. 2. Illustrating change of effectivity of minus lenses with change of position.

separation of convex lenses decreases the effectivity of the combination in the plane of the ocular lens. The separation of concave lenses increases the effectivity in the plane of the ocular lens.

If again, a — 7.00 D. S. is inserted in a trial frame cell, 8 mm. from a + 18.00 D. S. in the ocular cell, in refracting a postcataract case, then the effectivity of the single lens placed in the plane of the ocular lens should be + 18.00 D. S. — 6.60 D. S., or + 11.40 D. S.

Cylindrical lenses are to be handled in the same manner as spheres. The change in effectivity of any cylindrical lens when shifted from the most remote to the ocular cell, or vice versa, can be calculated from equation 1.

### CALCULATION OF AMOUNT OF AXIAL HYPEROPIA OR MYOPIA CORRECTED BY A GIVEN LENS.

Equation 1 also enables one to find the amount of axial hyperopia or myopia

corrected by any given lens (or system of lenses if reduced by means of equation 1 to the equivalent effective power in the position of the ocular lens). Since C is the change in effective power by reason of a shift in position of a lens, the amount of axial error A is found by adding the change in effectivity to the value of the dioptric power, D, of the lens used. The complete equation is, therefore:

$A=D+0.001\ s\ D^2$.....equation 2

Where A= axial error

D=dioptric power of lens used

$s$=distance of lens measured (in mm.) from cornea.

To illustrate the application of this formula, which is a modification of equation 1, let us calculate how much axial myopia is corrected by — 12.00 D. S. placed 15 mm. from the cornea. The answer is given as

$A=-12+(0.001\times15\times12^2)$

$=-12+2.16$

$=-9.84$ diopters (axial myopia)

Or if, again, a +8.00 D. S. is placed 10 mm. from the cornea, how much axial error is corrected? The answer is given by

$A=+8+(0.001\times10\times8^2)$

$=+8.64$ diopters (axial hyperopia)

## EFFECTS OF THICKNESS AND CURVATURE ON THE EFFECTIVE OR VERTEX POWERS OF LENSES AND ALSO ON THEIR NEUTRALIZATION VALUES.

A simple application of equation 1 enables any one to appreciate the essential and fundamental point underlying vertex, or effective power, as applied to modern ophthalmic lenses. It is hoped that a conception will be given of the changes in power produced when a lens of a given biconvex or biconcave (trial case) form is prescribed and subsequently manufactured on a —3 or —6 etc., base curve.

The approximate power of a thin lens is expressed as,

$D=D_1-D_2$.....equation 3

in which $D_1$ represents the dioptric power (as approximately given by a lens gauge, for instance) of the surface remote from the eye, and $D_2$ the power of the ocular surface of the lens. Equation 3 gives, therefore, a very close approximation to the power of a thin lens, irrespective of the choice of curvatures of the two surfaces. In other words, a lens is theoretically *thin* when the refraction caused by the two surfaces can be presumed to take place at a single refracting surface, which the two surfaces touch, passing thru the optical center. A *thick* lens fundamentally differs from a thin one in that it has, besides the surface refractions considered as lying in one plane, an internal plate of glass which possesses the property of laterally displacing all incident rays other than those perpendicular to the surface. In finding the vertex, or effective, or back-focal (ocular) power of a lens, we simply need to find the change in power C obtained by transferring the remote surface $D_1$ into the plane of the ocular surface $D_2$ when this transfer is made in a medium of glass having a thickness $t$ and an index of refraction $n$.

Hence the *vertex* or *effective* power $D_B$ of any lens is given very approximately as

$D_B=D_1+D_2+C_1$

But $C=ks\ D^2$ [general form of equation 1] or $C_1=0.001t/n\ D_1^2$.

Hence $D_B=D_1+D_2+0.001\ t/n\ D_1^2$..4.

In which $D_B$=vertex or effective power.

$D_1$=Dioptric power of surface more remote from the eye.

$D_2$=Dioptric power of ocular surface.

$s=t/n$.

The neutralizing power of a lens is obtained by finding the change C in power obtained by transferring the ocular surface $D_2$ into the plane of the remote surface $D_1$ thru a thickness of glass given as the lens thickness. Hence the *neutralization power* $D_N$ of any lens is given approximately as

$D_N=D_1+D_2+C_2$

But $C_2=0.001\ t/n\ D_2^2$

or $D_N=D_1+D_2+0.001\ t/n\ D_2^2$.....5

in which

$D_N$=Neutralizing power.

$D_1$=Dioptric power of surface more remote from the eye.

$D_2$=Dioptric power of ocular surface.

$s=t/n$.

Both equations 4 and 5, giving the ver-

tex and neutralizing powers respectively, indicate that the expression for a thin lens, which is the sum of the powers of the surfaces, is modified to give the effects of thickness, index and curvature thru the addition of a term which has the form given in equation 1.

To illustrate the application of equations 4 and 5 we are assuming the following conditions which are possible in practice: A +12.00 D. S. biconvex form is found to give, at 15 mm. from the cornea, the best visual acuity. A +12.00 D. S. is, therefore, ordered. If the lens furnished the wearer is of a biconvex form and the frame position is 15 mm., test room and final fitting conditions are the same. Suppose, however, a lens having the same thickness (5.2 mm.) and index (1.5) as the biconvex lens were supplied, and possessing dioptric surface curves of +18.00 diopters ($D_1$) and a —6.00 diopter ($D_2$) and ultimately put in a frame and mounted so as to have its ocular surface 15 mm. from the cornea. From equation 4 we find that the *effective* or *vertex* power is given as

$$D_B = 18 - 6 + (0.001 \times 5.2/1.5 \times 18^2)$$
$$= 12 + 1.15$$
$$= 13.15 \text{ D. S.}$$

Hene the vertex or effective power is +1.15 diopter greater, than the sum of the two curves of the lens. From equation (5) we find that the *neutralizing* value is given as

$$D_n = 18 - 6 + (0.001 \times 5.2/.5 \times 6^2$$
$$= 12.12 \text{ D. S.}$$

Hence the neutralizing value is 0.12 diopter greater than the sum of the two curves on the lens. If, therefore, the patient should be given the above lens, having a vertex power of +13.15 diopter, he would be overcorrected by +1.15 D. S. and probably would report dissatisfaction. On the basis of neutralization, however, the examiner would conclude, as has been shown, that the lens was not more than 0.12 D too strong; and would, therefore, be led into error as to the effective or corrective value of the lens, when worn by the patient. In lenses whose powers equal, or exceed three to four diopters, due regard should be given to the difference between neutralizing and vertex power.

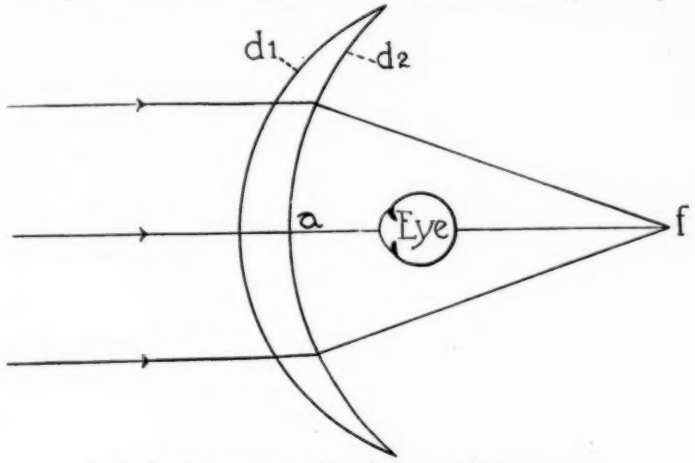


Fig. 3 $d_1$ = power of surface remote from eye.
$d_2$ = power of ocular surface of lens.
$af$ = back focal length.
$\frac{100}{af\ (cms)} = D_B$ = effective or vertex power.

In the case of minus lenses, however, since the center thicknesses can be kept practically constant (for example, 1 mm.) for all powers, there is little effect due to the added term expressed by equation 1 on either the vertex or neutralizing powers.

### EFFECTIVE OR VERTEX POWER OF CATARACT LENSES.

All physical and mathematical theory and practice point to the con-

clusion that biconvex or plano-convex lenses are not the best forms of cataract lenses. The conclusion apparently held by many ophthalmologists is to the effect that meniscus forms of cataract lenses are not satisfactory to the wearer. Obviously, from that which has been discussed in this paper, the effective or vertex powers of the two forms of lenses (biconvex and meniscus, which would be equal by neutralization methods) are far from being equal. The preceding problem shows that the neutralizing value of a +12.00 D. S. on a −6 base curve is +12.12 D while its vertex or effective value is +13.15, or an overcorrection of +1.15 D. As a result, therefore, it is apparent that the change of form of lens from biconvex to meniscus, which is highly desirable from the standpoint of wide-angle field of undistorted vision, also produces an appreciable change in the effective power with little effect on the neutralizing values of cataract lenses.

Again, if such a lens is a compound, we have marked changes both in spherical and cylindrical corrections. If the biconvex equivalent is +12.00 D. S.+6.00 cyl., we find, thru the application of equations 4 and 5 to each meridian in turn (that is, +12 and +18) that the effective power on a −6 base curve is +13.15 D. S. ⌒+8.00 cyl.

In Table 2 is given the plus lenses which might be used in postcataract corrections; their effective powers and neutralizing values, when made with various curves whose sum is equal to the dioptric power of the specified lens, are indicated.

Table 2 points out definitely that: (1) the neutralized values of lenses of any specified power, made with curves whose sum is equal to the specified power, are but little affected by the forms or thicknesses of the lenses; and (2) the vertex values (that is, their true corrective effects when placed before an eye) of any specified lenticular power are considerably affected by both the form and thickness of lens.

SUMMARY

The wide applicability and usefulness of a simple formula, $C=k\ s\ D^2$ (equation 1), connecting the change in power of a lens (either positive or negative, spherical or cylindrical) with change in its position before the eye is shown.

Table 2

CATARACT LENSES.

| Trial case lens | Thickness t, mm. | Index of refraction, n | Neutralizing power | | | | Effective power | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Biconvex | Plano-convex | Meniscus $D_2=-3$ | Meniscus $D_2=-6$ | Biconvex | Plano-convex | Meniscus $D_2=-3$ | Meniscus $D_2=-6$ |
| +8 | 3.8 | 1.50 | 8.04 | 8.00 | 8.02 | 8.09 | 8.04 | 8.17 | 8.32 | 8.53 |
| +9 | 4.2 | ... | 9.06 | 9.00 | 9.02 | 9.10 | 9.06 | 9.25 | 9.40 | 9.70 |
| +10 | 4.6 | ... | 10.08 | 10.00 | 10.03 | 10.11 | 10.08 | 10.32 | 10.55 | 10.84 |
| +11 | 4.9 | ... | 11.10 | 11.00 | 11.03 | 11.11 | 11.10 | 11.42 | 11.65 | 12.00 |
| +12 | 5.1 | ... | 12.12 | 12.00 | 12.03 | 12.12 | 12.12 | 12.52 | 12.80 | 13.16 |
| +13 | 5.4 | ... | 13.15 | 13.00 | 13.03 | 13.12 | 13.05 | 13.63 | 14.00 | 14.40 |
| +14 | 5.7 | ... | 14.19 | 14.00 | 14.03 | 14.13 | 14.19 | 14.79 | 15.18 | 15.65 |
| +15 | 6.0 | ... | 15.24 | 15.00 | 15.03 | 15.14 | 15.23 | 15.98 | 16.42 | 16.95 |
| +16 | 6.4 | ... | 16.28 | 16.00 | 16.03 | 16.15 | 16.28 | 17.18 | 17.70 | 18.30 |
| +18 | 7.2 | ... | 18.41 | 18.00 | 18.03 | 18.17 | 18.41 | 19.68 | 20.36 | 21.12 |
| +20 | 7.3 | ... | 20.51 | 20.00 | 20.04 | 20.19 | 20.51 | 22.91 | 22.91 | 23.90 |

This equation has been applied to the particular problems of changes of effectivity of lenses due to positions in the trial frame, the effect of frame position of lenses correcting aphakia and the general problem of finding the amount of axial hyperopia or myopia corrected by a given lens (equation 2).

Equation 1 has been applied to the calculation of the effects of thickness and curvature on the effective (or vertex) and the neutralization values of ophthalmic lenses. Equations 4 and 5 give the approximate vertex and neutralization values respectively.

Attention is drawn to the very important application of the points, cited in the article, to the form of lens prescribed in postcataract cases.

# THE PREGLAUCOMATOUS EYE.

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This is a statement of certain facts and the correlation thereof, to suggest a new hypothesis as to the development of acute inflammatory glaucoma. The essential factors are the predisposing anatomic construction of the eye, lack of tonicity in fibres that control the vasomotor system of the eyeball, a temporary rise in systemic blood pressure. Presented at the Chicago Ophthalmological Society, April 21, 1924.

## THREE FACTORS ESSENTIAL FOR THE DEVELOPMENT OF ACUTE INFLAMMATORY GLAUCOMA.

(A) *The predisposing anatomic construction of the eye.* The value of chamber angle in degrees, the location of the scleral spur and of the canal of Schlemm, the variability of the size of the spaces of Fontana, and the character of the endothelium and the weave of the iris at the chamber angle, all play a role. (Salzmann-Brown Anatomy of the Eye.)

The function of the chamber angle as the filtration area of the eye. (Leber, Graefe-Saemisch, Vol. II-2, first published in Graefe's Archiv, 1873.) This is still accepted despite the assertions to the contrary by Hamburger and others.

The frequency with which the chamber angle is obstructed in glaucoma. (Knies, Archiv f. Ophthal. XXII-3-p. 163, 1876; and Weber, Archiv f. Ophthal. XXIII-1-p. 1, 1876.) "Closure of the filtration angle is, in all early cases, caused by the base of the iris being pressed against the periphery of the cornea and the apposed surfaces becoming adherent." (Priestley Smith. Glaucoma, London, 1891; and Glaucoma Problems, Ophthalmic Review, 1910, 1911 and 1912.)

Consequently, the iris tissue becomes pressed against the posterior surface of the cornea, closing the sponge like surface of the iris (Hamburger, Klin. Monatsbl. f. Augenh. 1920, LXV) thru which there has been absorption up to this time, either direct or by filtration to the canal of Schlemm. (Fuchs, The Ophthalmoscope, 1908, p. 742.)

"Closure of the filtration angle is a cause and not a consequence of glaucoma. To the writer's mind, the evidence, tho circumstantial, is overwhelming." (Elliot, Glaucoma, 1922, p. 112.) "Pushing forward of the diaphragm of the eye, shallowing of the anterior chamber, and obstruction of the angle of excretion will follow, if we raise the pressure in the vitreous above that in the anterior chamber."
(Priestley Smith, Glaucoma, 1891.)

(B) *Lack of tonicity of the sympathetic nerve fibres that control the vasomotor system of the eyeball.* The choroidal tunic is about four times as thick as postmortem sections show it to be and is in reality a vascular reservoir that has for its purpose the maintenance of the normal tonus of the eye. (Magitot, Annal. d'Oculist., 1917, Vol. CLIV, pp. 211, 272, 334, and 385).

The large vessels of the choroid and ciliary body are continuous. (Brown-Salzmann, Anatomy of the Eye and H. McKee, Am. Encyc. of Ophthal.) This continuity permits of a variation in the fluid content of the eyeball by dilatation or contraction of the vessels, which may amount to as much as 45 cmm. or 1/5 to 1/9 of the entire volume of the eyeball. (Koster, Archiv. f. Ophthal. XLI, p. 2.) By means of the contractility of the arteries, the vasomotor nerves regulate the degree of pressure in the circulatory system and by the same means, the afflux of blood that pervades the organs. (Morax and Doyen, Vol. III, p. 199.)

The large vessels or blood reservoir of the eye are under the control of the sympathetic nerve fibres. "The sympathetic fibres control * * * the vasoconstrictor mechanism of the blood vessels of the eye and orbit. The sympathetic root (radix media vel sympathetica) from the ciliary ganglion contains vasoconstrictor fibres to the whole eyeball. (Whitnall, Anatomy of the Human Orbit, 1921, p. 352.)

The sympathetic fibres leave the spinal canal by the 1st, 2nd, and 3rd thoracic roots, and enter the lower

sympathetic cervical ganglion. They terminate around cells in the superior cervical sympathetic ganglion, which is the only interruption between the cord and the eye. (J. H. Parsons, The Innervation of the Pupil, Royal London Ophthalmic Hospital Reports, 1904, XVI.) From here fresh fibres pass by the internal carotid nerve accompanying the carotid artery into the skull. Here the nerve breaks up into the carotid plexus and the cavernous plexus, both lying closely along the carotid artery. From the latter plexus, there are two branches with which we are concerned: the first goes to the dilator fibres of the iris, by way of the gasserian ganglion and the long ciliary nerves. The other (the sympathetic root) passes thru the ciliary ganglion and is the vasomotor branch that enters the eyeball with the short ciliary nerves. (Whitnall, ibid.)

Section of the cervical sympathetic (see original experiments of Claude Bernard-Horner) causes an elevation of ocular tonus and at the same time dilatation of the vessels. (Bailliart and Magitot. Annal. d'Oculist. Jan. 1921.) Section of the cervical sympathetic in a rabbit causes dilatation of the retinal vessels. (Morat and Doyen, Arch. de Physiologie, 1892, p. 60). The sympathetic chain around the internal carotid was resected in a man and there resulted miosis, dilation of the retinal vessels, and increased intraocular tension (Leriche, Presse Médicale, May 15, 1920.)

The physiologic, but not the anatomic capillaries, are capable of changing their calibre under the influence of the vasomotor sympathetics. (Bailliart, La Circulation Rétinienne, 1923, p. 303.) "That the great choroidal reservoir may exercise a powerful influence on intraocular pressure, and especially on its variations from time to time, almost goes without saying. It would, however, seem probable that the object of all this mechanism is rather to prevent variations in intraocular pressure than to produce them. It seems easier to conceive of it as a regulating mechanism of the pressure conditions within the eye." (Elliot, Glaucoma, 1922, p. 57.)

The purpose of these cavernous spaces, whose size is controlled by the vasomotor sympathetics, in all probability is to form a stabilizing or regulating apparatus, to protect the eye against sudden changes in arterial pressure and the resultant damaging influence upon the eye. In all likelihood, the nerve impulses that actuate the protective mechanism, originate in the cavernous plexus of the sympathetic which surrounds the carotid artery. Thus a sudden rise in systemic blood pressure would not be accompanied by a relatively equal rise in the pressure in the intraocular arteries. [Normally the relation of the pressure within the arteries in the eye to the pressure in the brachial artery is as 45 to 100. (Bailliart, ibid. p. 55.] "While the systemic blood pressure tends, as it rises and falls, to exert a corresponding influence upon the intraocular pressure, this influence may be masked or even wholly neutralized by a number of other factors." (Elliot, Glaucoma, 1922, p. 81.)

Thus the regulation of the pressure in the intraocular arteries, and to a certain extent, the intraocular pressure depend upon the capability of the protective mechanism to function (contraction or dilatation of the blood vessels that form the intraocular blood reservoir). If the vessels that form the reservoir are dilated to their maximum, a change in systemic blood pressure will be accompanied by a like change in the pressure in the intraocular vessels, and there will be an increase or decrease in the actual content of the eyeball. On the other hand, if the protective mechanism is functioning, an increase in systemic blood pressure will be neutralized within the eye, by a change in the calibre of the intraocular blood vessels, so that the total content of the eyeball remains unchanged.

(C) *A temporary rise in systemic blood pressure.* It is a well known fact that systemic blood pressure may vary from day to day and from hour to hour. A blood pressure, that usually lies within the limits accepted as normal, may easily rise as high as 170 or even 200 mm. of mercury for a short time, under the influence of various

conditions as unwonted exercise, mental excitation, excessive eating, etc. (Barker and Cole, Blood Pressure, 1924.) That the rise is only temporary may be shown by the claim that there is no relation, either direct or indirect, between vascular hypertension and glaucoma, for in 45 cases of glaucoma, the blood pressure was normal in 22, subnormal in 7, and increased in 16 (35.6 per cent). In 90 control cases of the same age without glaucoma, the blood pressure was increased in 33.3 per cent. (Krämer, Graefe's Archiv. LXXIII, p. 349. Complete bibliography to date.) "The high blood pressure of general arteriosclerosis is not necessarily or even usually associated with a high intraocular tension." (Elliot. Glaucoma, 1922, p. 81.)

CORRELATION OF THESE FACTORS.

With these factors then in mind, let us attempt to visualize how an attack of acute inflammatory glaucoma may occur. In an individual with an eye of the type that is anatomically predisposed to glaucoma, for some unknown reason, there is a lack of tonicity of the vasomotor sympathetic nerve fibres, some place between the cavernous plexus and the eyeball. As a result of this, the cavernous spaces of the eyeball are filled to near their maximum capacity with blood, altho the tension of the eyeball is not yet raised to a clinically appreciable measure.

Then, there occurs a rise in systemic blood pressure, due to a heavy meal, an emotional crisis, or any one of the many factors that are recognized as capable of precipitating an attack of acute inflammatory glaucoma. The increased blood pressure cannot be compensated for within the eyeball, for the compensatory or regulating apparatus is already loaded to its maximum capacity. Consequently, the intraocular pressure is actually increased by the increased pressure within the blood vessels, which in turn yield an increased extravasation or transudation of fluid. As a result, the pressure within the vitreous chamber is increased, which in turn pushes forward the diaphragm of the eye (the lens, the zonule fibres, and the iris), shallows the anterior chamber, and obliterates the filtration angle. Thus is established the vicious cycle that culminates in the well known clinical picture of an acute inflammatory glaucoma.

Undoubtedly, many other factors, such as character and composition of the aqueous, chemistry of the circulating plasma, basal metabolism in its broadest sense, etc., play more or less important roles and it is impossible to estimate exactly how great are such influences. Among these must be mentioned the factor that causes the lack of tonicity in the sympathetic fibres between the cavernous plexus and the eyeball. Inasmuch as there may be a unilateral angiospasm, probably due to sympathetic nerve irritation, as in migrain, why may not a unilateral lack of tonicity of the same sympathetic nerve be equally probable? The migrain angiospasm is not accompanied by any disturbance of the pupil, and hence the exciting nerve irritation must lie peripheral to the 1st branch of the cavernous plexus. Equally, the atonicity causing the dilatation of the blood reservoirs of the eye is not accompanied by a pupillary contraction, and hence must involve that part of the sympathetic tract that lies between the branches of the cavernous plexus and the eyeball. In 13 cases in which there was a glaucoma in one eye and the other eye of the patient was normal, there was a marked difference in the pressure in the retinal arteries in 9. (Bailliart, La Circulation Retinienne, 1923, p. 303.)

This correlation of the three factors cannot be proven experimentally because of the different anatomic construction of the eyes of possible experimental animals from that of man. Therefore it is merely suggested as a possible hypothesis to explain some of the features of that disease of most mysterious origin, acute inflammatory glaucoma.

# ACCOMMODATION IN MYOPIA.

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The classic statement of a difference in form of the ciliary muscle in myopic eyes, from that found in hyperopia, is taken as the starting point for a discussion of differences in accommodation between myopic and hyperopic eyes. An argument is made against the giving of a full correction for near work, in myopia of more than 3 D. The degree of correction should be determined by the prescriber's knowledge of the accommodation, in the individual case. Read before the Section on Ophthalmology of the College of Physicians of Philadelphia, March 19, 1924.

The original illustration of the ciliary muscles in hyperopia and the ciliary muscles in myopia published first by Arlt and reproduced in most of the text books since his day is familiar to you all. You will remember that in hyperopia the circular fibers, and in myopia the longitudinal fibers are relatively overdeveloped. It is obvious from these microscopic slides that in hyperopia accommodation is of greater power than in myopia. This is, I believe, universally admitted.

It would be interesting to study the slides made from the myopic eye for which full correction had been worn for far and near in order to satisfy ourselves that the circular fibers are increased in number or in circumference by the enforced use of the accommodation. Clinically this increase in power might be determined by successive examinations of the patient to measure the distance of the near point for a few minutes and then for longer and varying lengths of time. I am not aware that such trials have been made. The full correction of myopia is recommended by text book authorities for distance and for near, unless the degree is high—that is above 5D. or 6D., especially in the young. The practice is based upon the assumption that the accommodation will be developed by exercise and that the myopic eye could then be considered on a plane with the emmetropic eye.

Our notion of the action of the ciliary muscle is, in brief, that the circular fibers by contracting reduce the diameter of the circumlental space and that the lens owing to its own elasticity expands in its anterior-posterior diameter. This theory, which is probably correct and is accepted as such, ignores entirely the radiating fibers. What is the function of the latter and how do they assist in bringing closer to the eye the near point? They are in most eyes, if we may trust the illustration mentioned, always present and in greater number and volume than the circular fibers.

They may act in one of the two ways. First, with their insertion or anchorage in the anterior half of the choroid, their contraction would compel the drawing backward and possibly inward of the angle of the anterior chamber by means of the ciliary ligament. By this result of their contraction the circumlental space is again narrowed and the circular fibers reinforced. 2nd. If, however, the angle of the anterior chamber or the insertion of the ciliary ligament be the fixed point, the contraction of the radiating fibers means the drawing forward of the choroid, which might have the effect of flattening the lens by pressure of the vitreous body rather than relaxation of the zonule of Zinn.

If, as stated, the choroid is brought forward in acts of accommodation, the angle of the anterior chamber must always be the fixed point. The actual bringing forward of the choroid means also synchronous and equal movement of at least the anterior portion of the retina. It is quite possible to conceive that the choroid is not changed in its position and its relations, but that circumlental space is reduced in size by contraction of the muscle fibers alone that constitute a part of the ciliary body and of the choroid.

By what process the radiating fibers are developed in myopia as shown in the classical diagrams is to my mind uncertain. It is assumed that this is the case in those persons who have not worn glasses for the near point, as we know there is very little need for the use of accommodation in myopia

of 3D, and none at all in higher grades. If the radiating fibers are the active ones and if they are part of the accommodation apparatus, we can hardly understand why they are relatively underdeveloped in hyperopia, according to our theory of accommodation; and on the other hand, what is their function when the myopia is corrected for the near point and full accommodation is demanded?

I contend that it is of no advantage to the myope of medium and high grades to wear full correction of the myopia for near. If the accommodation is accomplished as above stated; namely, contraction of the radiating fibers and the drawing forward of the choroid and ciliary processes, its exercise must be attended by dragging of the choroid away from the optic nerve and the creation, at least partly, of choroidal thinning or atrophy, if not of the actual staphyloma. The high myope, 10D.-20D., has no accommodation worth mentioning, in spite of his abundant radiating fibers. He has, however, posterior staphyloma because of stretching of the sclera which apparently contradicts the previous statement. To force such a pair of eyes to use accommodation or to attempt to develop power of accommodation must lead to disaster. The same reasoning applies to the lower grades until we reach 3D. or under. The argument so often advanced for the full or nearly full correction for constant use, that the external lateral muscles are better equipped to maintain balance has but little weight. Exophoria belongs to the high grades and is mechanical. Myopia increases from constant near use of the uncorrected eyes: it also increases under the same conditions in corrected eyes.

The degree of correction for near depends to a certain extent upon the prescriber's knowledge of the power of accommodation in the individual case; and his judgment as to whether accommodation should be exercised or whether asthenopia may be prevented and the welfare of the eye safeguarded by such correction as will bring the reading distance to the desired point without accommodation. We cannot think of the myopic eye even when fully corrected and with full visual acuity as a healthy eye. It is theoretically identical with the emmetropic eye in that the focus of the refracting media together with the lens placed in front is always brought where it should be; but in no other respect is it the same.

The myopia has been induced by too much accommodation, or it has come by inheritance, or there is an inherited tendency of the sclera to stretch and of the choroid to atrophy. In short the myopic eye may not be considered a perfectly healthy eye. It should be saved from all unnecessary effort. Observation of patients thru a series of years would be necessary before conclusions may be reached as to the effects upon the degree of myopia, the choroidal changes and the vitreous opacities in order to formulate any plan of treatment.

In my own experience, myopia has advanced in young persons whether they have worn full or partial correction, and this is true in both high and low degrees. Recitals of case histories are unnecessary. Moreover they would prove nothing more than the happenings of the individual case. My experience leads me to believe that while progressive myopia may not be checked by lenses, its advance will be less rapid in these case in which strain of accommodation, or perhaps it would be more accurately expressed to say use of accommodation, has been only partial or completely in abeyance, by wearing of such a glass as will make the near point the reading distance.

Presbyopia, or early presbyopia, as an expression to convey the meaning of lessened accommodation in myopia in young subjects is not correct. The accommodation always has been less than that of the hyperope or emmetrope. Even in myopia as low as 3D. a reading glass of less strength would be advantageous to these patients whose time is largely spent in close work. The occupation, the age of the patient, the degree of myopia, the previous use of glasses, all must be considered in determining the relative strength of the near glass.

# INTRACAPSULAR CATARACT EXTRACTION WITH THE REPORT OF THIRTY CONSECUTIVE OPERATIONS. ERISIPHAKE.

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MANILA, P. I.

This is a frank summary of the difficulties and results attending thirty extractions by phakoerisis in patients presenting senile cataract in Manila.

Cataract is a common eye disease in the tropics. In India, for instance, hundreds of cases are operated annually. In the Philippines it is also common, and it is one of the most frequent conditions among eye cases admitted to the Philippine General Hospital requiring operation. In view of this fact ophthalmologists in the Orient should be acquainted with the different methods of successfully treating this condition. We do not, however, mean that the cataract surgeon should endeavor to become equally proficient with the different technics or procedures of cataract extraction, but rather, as advised by Jackson, to master a particular one which seems to him most rational and effective and which in his own hands will give the best visual results with the minimum of risks or complications.

The purpose of this paper is to report further on our experience with Barraquer's phacoerisis and the results obtained in this next series of thirty cases. A report on the first ten cases operated by the senior author (Dr. Ubaldo) was published in the November Number (1923) of the AMERICAN JOURNAL OF OPHTHALMOLOGY.

## ANALYSIS OF CASES AND RESULTS.

*Age:* Average age is 58 years; the youngest being 40 and the oldest 78.

*Sex:* 9 males, and 16 females. In 5 of these both eyes have been operated, making a total of 30 operations in 25 patients.

*Eye Operated:* Right eye: 11; left eye: 9; both eyes: 5.

*Iris:* All with normal reactions, except in one patient who had posterior synechia in both eyes as a result of gonorrheal iritis which the patient had before.

*Condition of the Cataract:* All appeared as mature, senile cataract, but on extraction four were found to be soft.

*Ocular Tension:* Average 20 mm. of mercury with the Schiötz tonometer. None in the series had a tension above the normal limit. Those cases attended with much prolapse of vitreous did not have high tension at all.

*Blood Pressure:* Average systolic, 135; diastolic, 76; the highest systolic being 200. From our figures we observe that there seems to be no relation between a high blood pressure and the occurence of vitreous prolapse.

*Iridectomy:* In all of the cases button hole peripheral iridectomy was made, except in three cases where a portion of the iris including the margin accidentally fell on the blade of the knife while making the incision and iridectomy resulted. In two other cases button hole cut on the iris was accidently done while performing the incision.

*Loss of Vitreous:* This is one of the most dreaded accidents or complications that may happen during the extraction. Out of these 30 cases, the loss was considerable in 4 (this mainly due to the squeezing of the lids of nervous patients, the orbicularis not being well paralyzed), moderate amount in 2, and in 2 others only slight.

*Prolapse of the Iris:* This happened in 3 cases: in one because no peripheral iridectomy was done; and in the other two because of the loss of much vitreous proper replacement of the iris could not be done.

*Other Accidents:* Besides the prolapse of the iris and vitreous there has been also annoying bleeding into the anterior chamber, which interfered with the introduction of the erisiphake, and in determining whether there is proper coaptation between the cup and the lens surface. In one case the blood clot plugged the hole of the erisiphake necessitating its removal with a fine wire.

*Rupture of the Capsule:* This occured in 3 cases, the condition of the

cataract in all these cases being soft. We attribute this to too much suction. In this connection it is well to bear in mind the advice of Barraquer, that it is very important to determine as much as possible the condition of the cataract and of the zonule, and thereby regulate the degree of the vacuum to be used. This, however, requires much experience, and we are now beginning to make this study with the help of the corneal microscope.

*Delivery with the Loop*: This had to be resorted to in 3 cases. In one case suction could not be produced because of some trouble in the erisiphake, while in the other two cases the lens became readily dislocated while the cup was being placed in apposition with the surface of the lens, and so it had to be removed with the loop.

*Rupture of the Button Hole*: This occured in 3 cases, the lens being very large and the pupil not properly dilated.

*Postoperative Course*: The bandage or eye dressing placed after the operation is not removed until after the 6th day, unless the patient complains of pain. In the majority of cases the corneal wound healed up well with very slight reaction (in the form of slight edema and reddening of the conjunctival flap) or none at all. In a few cases, slight opacity of the cornea in the neighborhood of the incision has been observed. This, however, disappeared in the course of a few days. Three cases developed rather severe iridocyclitis, and in four, floating blood clots in the vitreous were seen. In one case with posterior synechia, the lens was successfully extracted, but later there developed a flaring up of the old gonorrheal iritis, membranous exudate formed in the pupillary area, and vision remained poor.

The patients stayed in the hospital on an average of 18 days. One, however, stayed only 6 days, another for 12 days. Those cases that developed severe reaction naturally had to stay longer.

## VISUAL RESULTS.

The visual acuity (i.e. with the correcting glasses) obtained in these cases, taken at about the time of their discharge, was as follows:

Vision 20/40 =5 cases.
" 20/50 =7 "
" 20/70 =6 "
" 20/100=3 "
" 20/200=6 "

Vision counting fingers 3-14 feet= 3 cases.

It is to be regretted that among the 30 cases in this series not one had a vision of 20/20 after the operation. Even in those cases that had a nice healing of the wound, and did not have any complication at all, either during or after the operation, we did not get the normal vision.

However, our visual results if not what may be called very satisfactory are neither on the whole discouraging, taking into consideration the following: (1) that we have as yet limited experience with this technic, and (2) that those cases that had reaction had been refracted rather too early. A case, for instance, discharged with vision counting fingers only for a distance of three feet, could read 20/70 one month after, i.e. after the vitreous had cleared up well. In many cases, especially in those coming from the provinces, a longer period of observation could not be had inasmuch as they had no place in the city where they could stay.

## CONCLUSIONS.

Intracapsular cataract extraction offers certain distinct advantages over the simple extracapsular extraction. Now, of the two methods of intracapsular extraction (the Indian-Smith and Barraquer's) which one should be of preference? Some years ago the senior author of this paper tried the Indian-Smith technic on several cases, but it had to be abandoned because of too much loss of vitreous which attended almost all of his cases. From the experience we have had with these two methods we are of the opinion that with due care Barraquer's technic offers less danger of vitreous extrusion than the other, and the result in vision is much more satisfactory. Of course this operation is one difficult to perform, but cataract operation by any method demands great skill, if one expects good results. We believe that with the acquisition of more experience, and with more confidence in

this technic and careful study of every step or detail in the operation, as emphasized by Barraquer, our results would be much better. We believe that the following should be given full consideration by one using this technic:

*First.* Barraquer lays much stress on the preliminary and thoro examination of each individual case to determine the condition of the cataract. According to him the vacuum to be used must depend on this condition of the cataract and of the zonula fibers in order to properly deliver the lens. And in his own words: "Only practice and a thoro and prolonged previous examination of the physical condition of the zonula and the lens can enable us to determine the degree of vacuum to be employed."

*Second.* Care must be taken that before suction is employed the platinum cup must have every point of it in coaptation with the surface of the lens, for otherwise aqueous, blood clots, or even vitreous may be aspirated.

*Third.* "Care must be taken that the lower edge of the crystalline lens follows the curve of the patellar fossa, without the slightest pressure upon the surface of the hyaloid membrane; and that the posterior surface rubs against the scleral lip of the wound."

*Lastly,* it is essential, of course, that the apparatus be scrupulously examined, to see that it is in an excellent condition.

## ETIOLOGY AND TREATMENT OF OCULOMOTOR DISTURBANCES.

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This is a general review of the subject based on the anatomy of the parts and the physiology of the movements. Types of paralysis are classified as structural, insertional or innervational. The congenital defects are first taken up, then traumatic and causation by intracranial and spinal lesions. General diseases especially the infections and diseases of the neighboring parts are considered. Treatment depends chiefly on etiology, but later operation may be indicated. Read before the Chicago Ophthalmological Society, Feb. 18, 1924. See p. 636.

In the normal working of the eyes, the muscular and nervous mechanism which controls their motions is designed to accomplish one single purpose, namely, to so move the eyes that they shall both be directed accurately to the object we wish to see, and each eye shall receive an image of that object upon the fovea. The movements of the two eyes should, therefore, be so coordinated as to obtain binocular fixation under all conditions—orthophoria.

Derangements of binocular fixation range all the way from heterophoria to heterotropia, squint or strabismus. The heterotropias are of two varieties: (1) Comitant, in which the amount of deviation remains the same when the eyes are carried back and forth in different directions and (2) noncomitant if the amount of deviation changes notably. Noncomitant deviations are usually paralytic in origin, but occasionally spastic. A comitant deviation is not paralytic in origin, but may develop out of a paralysis.

The normal motions of the two eyes working together are either conjugate or parallel, or the distinctive movements of convergence and divergence.

The nerves which preside over ocular movements are the third, fourth and sixth cranial pairs, which supply the exterior ocular muscles, and the sympathetic, which supplies the dilator pupillae. The first three mentioned arise from nuclei in the midbrain, in the floor of the fourth ventricle. These nuclei are connected with various supranuclear centers which affect the various coordinate binocular movements. They are called association centers. The nuclei of the two sides are interconnected by transverse fibers, and the nuclei of the same side by the posterior longitudinal bundle, which also connects them with the facial nerve, and thru Dieters' nucleus with the labyrinth. They are likewise con-

nected with the anterior corpora quadrigemina, and either directly or indirectly by decussating paths with centers in the cortex. It seems likely that the middle frontal convolution is especially concerned in the production of conjugate eye movements.

The coordinate movements of the eyes are either voluntary or involuntary. The latter comprise movements produced by reflex stimuli, visual or labyrinthine, and those occurring in association with other motor mechanisms. The reflex movements due to visual impressions comprise the movements by which the necessary adjustments to secure fusion are developed in infancy, and the similar movements occurring later in life by which the visual impressions set up by an object forming its image on the periphery of the retina impel both eyes subconsciously to turn toward it.

The various deviations which are present in heterotropia, we are all familiar with and do not require enumeration. Deviations may be classified according to cause, as (a) an anomaly of structure, insertion or innervation of one or more of the ocular muscles (muscular paralysis and spasm); (b) anomalies of the coordinate movements of the eyes, the muscles being normal, which include anomalies of convergence and divergence (excess and insufficiency) and anomalies of conjugate movements, conjugate paralysis and spasm, nystagmus, and dissociated movements.

On account of the very large field which would have to be covered if the entire subject of the etiology and treatment of oculomotor disturbances were considered, I have confined my part of the program to the noncomitant deviations.

Given a case of heterotropia, which has been examined as to the deviation and limitation of movement, the presence or absence and the character of the diplopia, the presence or absence of false projection, and having observed the character of the head tilting if present, and having thru these observations determined that a paralysis exists and that it affects a certain muscle or groups of muscles in one or both eyes; in short, having made a definite diagnosis of a muscular palsy of the eye, we must classify the paralysis from several different angles before we are in a position to proceed with the case along rational lines.

All types of paralyses are seen from time to time and under various conditions—those affecting a single branch of a widely distributed nerve, those affecting the entire nerve, and those which involve two or even more of the oculomotor nerves in all of their branches, such a condition being termed total ophthalmoplegia. The eyeball then is motionless, the pupil is widely dilated and the accommodation is entirely abolished. A more or less complete paralysis of all the exterior muscles without implication of the sphincter pupillae or the ciliary muscle is known as ophthalmoplegia externa.

Classified according to the muscles involved, we speak of extraocular paralyses and intraocular paralyses; according to the site of the lesion, as extracranial (orbital or peripheral) and intracranial, comprising basal and foraminal, nuclear and fasicular, supranuclear and cortical.

From the standpoint of etiology there are three varieties of paralyses: (1) structural; (2) insertional and (3) innervational.

(1) A structual paralysis is one in which some abnormality of the muscle itself is present—a congenital defect, a solution of continuity, an inflammation or new growth in the muscle or its surroundings limiting its action, or an atrophy of the muscle.

(2) An insertional paralysis is one in which the muscle and its nerve supply are normal, but in which the muscle is improperly inserted as the result of either a congenital misplacement, an accident or an operation.

(3) An innervational paralysis is one in which muscle and tendon are normal, but in which there is some abnormality of the nerve or its central connections.

With an innervational defect, the abnormality may be (a) congenital defect; (b) solution of continuity; (c) a cerebral circulatory disturbance, an inflammation or an atrophy of the

nerve or its nucleus or a degenerative process in the nerve or nucleus.

Either structural, insertional or innervational paralysis may be due to a congenital defect, a congenital defect may be due to absence of a muscle, its replacement by connective tissue, underdevelopment, abnormal course and insertion, adhesions between the muscles or the muscles and the orbital wall, aplasia of the nerves, either in the orbit or in the cranial cavity, or the nuclei of the nerves.

It may be caused by injury due to forceps delivery, which is not strictly congenital, and more rarely due to prenatal inflammation or degeneration.

Congenital paralysis may occur under all forms:

(A) Involving the superior rectus alone or with the levator, being either binocular or monocular.

(B) The levator alone, being either unilateral or bilateral.

(C) Paraylsis of the externus with paresis of the internus and retraction movements. This variety of congenital paralysis is a not uncommon type and usually affects one eye. The affected eye usually does not move outward beyond the median line; movement inward is more or less restricted and apparently difficult, and is accompanied by a retraction of the eye into the orbit, and frequently with a sudden movement up and inward or down and inward, and a narrowing of the palpebral fissure.

The patient may have single vision when looking straight ahead, and may have either a crossed or a homonymous diplopia, depending upon in which direction the attempted movement of the affected eye is made. Convergence in such cases is usually much impaired. In this variety of paralysis, the underlying cause is a congenital absence of the external rectus or its transformation into a cord of connective tissue. The retraction of the globe in these cases is due either to the lack of elasticity of this cord or to an anomalous insertion of the internus.

There are also cases of what is known as strabismus fixus (fixed strabismus). In this condition, the eye is turned strongly inward and cannot be turned outward, even by the use of forceps, the eye seems to be fixed by strong bands of adhesions attaching it to the inner wall of the orbit, tends to get worse with advancing years, and is not always congenital; this affection is usually bilateral.

Many objective signs have been cited by which we may determine whether a given paralysis is congenital or acquired, but all probably are unreliable except the reaction to regeneration, which is said to be present in acquired and absent in congenital palsies.

ETIOLOGY.

The effect of heredity is seen in some forms of congenital paralysis, but Duane calls attention to the fact that heredity also plays an important part in inducing the conditions which frequently lead to paralysis; such as arteriosclerosis, syphilis, etc. Congenital paralyses in the majority of cases are due to nondevelopment or faulty development of the muscles themselves and are, therefore, of the type of an orbital paralysis in most cases.

Traumatism is a frequent cause of oculomotor paralysis. The external rectus being the muscle most frequently affected, it is most frequently unilateral, but occasionally bilateral. Being due to injury of the muscle itself or to that part of the nerve lying within the orbit, when bilateral it is often associated with a basal fracture; and particularly with those running thru the petrous bone.

Complete or partial paralysis of the third nerve is often basal, being due to fracture of the base or to penetrating wounds thru the orbit, or mouth. Isolated paralyses of the superior or inferior rectus or the inferior oblique are often due to trauma within, or involving the bones of the orbit. The same may be said of paralysis of the levator and of the superior oblique.

Traumatic paralyses are frequently due to direct injury to the muscle, or nerve (as after operations), or to compression from a displaced fragment of bone, or a hematoma, to a callus, and still less often to an aneurysm or an abscess secondary to an injury; such

an aneurysm or abscess may be either in the orbit or in the brain. Very seldom is a traumatic paralysis of nuclear origin. A traumatic paralysis of the eye muscles is occasionally associated with enophthalmos. The phenomenon may be due to loosening of the oblique attachments, or the attachments of the check ligaments, and occasionally to paresis of the superior cervical sympathetic, in which case ptosis and miosis are likely to be present, or coming on later may be due to retraction of scar tissue in the orbit. I have personally seen two cases in which enophthalmos was associated with penetrating injury of the orbit with paralysis of the internal rectus. Exophthalmos accompanied by oculomotor paralysis has been present after injury, particularly where there has been either a hemorrhage, an abscess in the orbit, or an orbital emphysema.

Vascular changes in the brain may be responsible for both basilar and nuclear paralysis of the eye muscles. The changes which are found are sclerosis of the blood vessels, which act by direct pressure of the enlarged vessel, or by hemorrhage; embolism by causing ischemia of a nuclear area; or aneurysm by direct pressure on nuclei, root or trunk of a nerve, as in the case of the internal carotid involving sometimes the third, the fifth, and sometimes the fourth and sixth, or by hemorrhages from miliary aneurysms of small vessels, which may produce basal or nuclear paralysis.

Increase of intracranial pressure from hydrocephalus, brain tumor, brain abscess, or meningitis causing either direct or indirect pressure. Inflammation of the brain and its meninges, as in encephalitis where eye muscle paralyses are common, both in the encephalitis of adults and in the type known as cerebral infantile paralysis. Abscess of the brain, particularly of otitic origin, affecting the temporal lobe may be the cause of paralysis of the third and occasionally of the sixth nerve.

Polioencephalitis superior, in which there is a hemorrhagic infiltration and degeneration of the gray matter about the ventricles, is a cause of complete and incomplete ophthalmoplegia.

The disease produces destruction of the nuclei and association tracts. It is said to occur most frequently in alcoholics, and is often precipitated by an attack of influenza. It is usually fatal.

Syphilitic and tubercular meningitis and cerebrospinal meningitis by affecting the nerves at the base, either by inflammatory exudate causing pressure or by direct extension of inflammation to the nerves, may be the cause of paralysis of the abducens or of the third nerves. In cerebrospinal meningitis, ptosis is particularly common. Paralysis of the third and sixth are also frequently present in acute bulbar paralysis, and ptosis is a very early symptom of myasthenia gravis.

In tumors of the brain, such as gumma, tuberculoma, glioma and sarcoma, and especially tumors of the hypophysis, the third nerve is likely to be affected, tho the first, second, fifth, seventh, and twelfth are also frequently involved.

Tumors of the pons, which so frequently give rise to paralysis of the abducens, are often associated with paralysis of the seventh, and particularly with a crossed paralysis, and are many times found to have also affected the fifth, eighth and twelfth nerves.

Spinal diseases are a frequent cause of paralysis of the eye muscles, tabes, multiple sclerosis and syringomyelia in particular being the cause of many cases. One author states that 20 per cent of all ocular palsies are due to tabes, and that one-fifth of all tabetic patients have ocular paralysis. Partial or complete paralysis of the third nerve is the most frequent, occurring in over 50 per cent of the cases. Paralysis of the abducens appears in 35 per cent, and of the fourth nerve in 8 per cent of cases, while in 5 per cent all of the external muscles are affected. In about 25 per cent of these cases the optic nerve is also affected, and in 10 per cent there is facial paralysis.

Paralyses of the eye muscles occurring early in the course of tabes are

likely to be transient; particularly is this true of ptosis, and they are thought by some authors to be of peripheral origin, while those which come on late in the disease are not only more complete, but also more lasting and permanent, and are said to be more commonly of nuclear origin.

Multiple sclerosis shows from 18 to 20 per cent of ocular paralysis, paralysis of the abducens being most commonly seen and trochlear paralysis rare. These paralyses are among the earliest symptoms and they are usually incomplete and transitory, a permanent paralysis being rare. The site of the lesion in these cases may be either nuclear or peripheral.

In syringomyelia, ocular paralyses occur in something over 10 per cent of cases, and here again, the abducens is most frequently affected.

In acute ascending paralysis, the most common oculomotor disturbance is bilateral abducens paralysis, with unilateral abducens coming next in frequency, with frequent involvement of the third and fourth nerves. The lesions occur both in the nuclei and in the peripheral nerves, and sometimes are found to be degenerative changes in the muscles themselves.

The condition known as progressive muscular dystrophy causes orbital paralyses which are due to atrophic changes in the muscles themselves. In general paresis, oculomotor palsies occur in a very small proportion of cases, and when they do occur they are many times among the prodromal symptoms of the disease. They are usually transitory in character, tho occasionally a total ophthalmoplegia will develop late in the disease.

Hysteria, neurasthenia and traumatic neuroses are rarely the cause of a true ocular paralysis. Most of the cases which present motor disturbances of the eye muscles are either found to be muscle spasm or pseudoparalysis, temporarily affecting the associated lateral movements or convergence, with occasionally a ptosis which is due to spasm of the orbicularis or to an anesthesia of the lid. One of the characteristic symptoms of these cases is, that if ptosis is present, effort to raise the lid is not associated with the usual contractions of the occipitofrontalis, and if there is disturbance of the associated movements, the patients are apt to complain not of diplopia, but of triplopia or polyopia.

Many general diseases, particularly those which are of an infectious character, are capable of producing oculomotor paralysis, among which are syphilis, diphtheria, influenza, tuberculosis, rheumatism, typhoid fever, malaria, cerebrospinal meningitis, beriberi, herpes zoster, pneumonia, tetanus, mumps, whooping cough, erysipelas, and severe pyogenic infections. Particularly notable in this group is syphilis, in which oculomotor paralyses are a very frequent tertiary manifestation of the disease.

Independent of the postsyphilitic affections (tabes, general paresis and lesions of the blood vessels), syphilis produces paralysis of the eye muscles by causing periostitis or gummatous infiltration in the orbit, at the base of the brain and involving the nerve nuclei and their association fibers in the brain.

Probably nearly one-half of the cases of ocular paralysis are thus due directly to syphilitic changes. The most of these cases are due to basilar changes, the third nerve being the one most commonly affected, either partially or completely, tho any or all of the oculomotor nerves may be affected. The paralysis usually develops suddenly, and may be preceded by headache and pain along the branches of the fifth nerve. There also may be optic neuritis with field changes, such as central scotoma or a contraction of the field, which later may become more or less symmetric or even of a hemianopic character, especially if the region of the chiasm is occupied by a syphilitic exudate.

The paralysis which develops in these cases is often progressive, but may be stationary, and has not the tendency to such variations as in tabes, neither has it the tendency to affect a single muscle as is so often the case in tabes. It is usually, in fact almost invariably, the acquired type of the disease which causes these manifesta-

tions, and very rarely the congenital form of the disease.

Diphtheria is another of the infectious diseases which causes paralysis of the eye muscles, a paralysis of accommodation affecting both eyes being the most common variety, occurring in about 5 or 6 per cent of all cases of diphtheria, while in about two or three per cent of cases some of the external eye muscles are affected. Most often it is the abducens which is involved, and many times it is bilateral and often associated with paralysis of accommodation.

In severe epidemics of this disease, paralysis of the external muscles is likely to occur, while in light epidemics, paralysis of accommodation alone is usually seen. Trochlear paralysis may be found in some of these cases, and paralysis of the soft palate not infrequently appears along with the eye muscle disturbance. Practically all of the cases recover, tho the paralysis may at times pass from one muscle to another before recovery takes place. Occasionally, where there has been a paralysis of the abducens in a small child, from diphtheria or from some other cause, the child loses its fusion faculty during the period of the paralytic deviation, and the squint remains after recovery of the paralysis has occurred, being changed, however, from a paralytic to a comitant squint.

The lesion causing the paralysis in diphtheria is said to be due to disease of the blood vessels supplying the nuclei, with capillary hemorrhages in the nuclei or the nerves, and to neuritis, either basal or orbital, and at times to change in the muscles themselves.

Influenza is given as a cause of paralysis of accommodation and of paralysis of the extraocular muscles, the abducens being most commonly affected from this cause, tho a part or even all of the branches of the third nerve may be involved, and occasionally complete paralysis of all the muscles of the eyeball has been observed in this disease. The paralysis of accommodation is usually bilateral, while that of the exterior muscles is usually unilateral. As a class, these cases usually recover tho occasionally a permanent paralysis results. The lesions are the same as those found in diphtheria, tho occasionally they are of the type of polioencephalitis superior or of a true encephalitis. There are also cases in which the causes of the paralysis is an orbital lesion of some sort, phlegmonous or hemorrhagic, or an inflammation of Tenon's capsule.

Tuberculosis may be the cause of ocular palsy by way of inducing a tuberculous meningitis, and occasionally by the production of a lesion at the base, or at the site of the foramina of exit of the nerves, tho rarely if ever is it due to a nuclear lesion.

Rheumatism, particularly the acute articular type, by metastases may produce oculomotor paralyses by producing orbital cellulitis or abscess, tenonitis, or even meningitis. There are also cases classed under this head which seem to result from exposure to cold in individuals who suffer from chronic rheumatism, the motor nerve disturbance being usually associated with severe trigeminal neuralgia and often with facial paralysis. These cases usually recover under elimination and rest and the removal of any foci of infection which can be found, particularly those in the mouth, nose and throat, which may insure a permanent recovery.

In typhoid fever, paralysis of the eye muscles has been observed occasionally in the third and fourth week of the disease, and has been explained as being due to meningitis, hemorrhage, and peripheral neuritis.

Cerebrospinal meningitis is particularly likely to show paralysis of the abducens and of the levator, causing ptosis. The paralyses are usually due to pressure from exudate at the base or to the extension of inflammation to the nerves themselves.

Herpes zoster ophthalmicus is not infrequently associated with paralysis of one or more of the eye muscles, particularly some of the branches of the third. This is particularly true of the severe cases which are accompanied by fever and other toxic symptoms. The disturbance is, of course, due to a neuritis, which has its origin in an inflammation or degeneration in the cell

bodies of the neurons which form these motor nerves, or to extension of inflammation from the sensory fibers of the fifth directly to the motor nerves in their peripheral course.

Beri beri and malaria are known to have produced paralyses which are transient in character.

Tetanus, mumps, whooping cough, erysipelas and pneumonia and pyemic states may cause paralysis by producing meningeal inflammation, hemorrhage due to convulsions of coughing or general convulsions, or to orbital abscess or cellulitis in the pyogenic conditions. Then, too, metastatic diffusion of septic thrombi thru the blood vessels may cause nuclear or supranuclear lesions to develop.

The general diseases not of an infectious character which may cause oculomotor disturbances are diabetes mellitus and insipidus, renal disease, Graves' disease, acromegaly, gastrointestinal disturbances, profuse hemorrhage and poisons.

In diabetes mellitus, paralyses are most commonly due to neuritis which develops as a result of the toxic state accompanying the disturbed metabolism, tho in some cases of diabetes insipidus both the diabetes and the paralysis are due to a lesion about the floor of the fourth ventricle.

In renal disease, the paralysis is usually secondary to the arterial degeneration which is present, and which is the forerunner of the hemorrhage. Like the renal cases which have retinal changes with hemorrhage, they have a very bad outlook.

Graves' disease occasionally causes paralyses of the abducens and less often of the portion of the third supplying the external muscles; occasionally, tho rather rarely, the muscles of both eyes may be affected, and sometimes ophthalmoplegia externa of one or even both eyes may be seen.

The palsies may be either transient, or may persist for a long time, or may even be permanent. Aside from the statement that the nuclei of the nerves are usually the seat of the trouble, there is no explanation of the pathology which occurs there.

Acromegaly, being due to tumor of the hypophysis, causes oculomotor disturbances by direct pressure on the nerves and centers, and by the effect of the toxemia which seems to exist. The third nerve in part, either unilateral or bilateral, is the one most commonly affected, while the fourth and sixth are rarely, if ever, involved, according to most authorities.

Profuse hemorrhage, gastrointestinal disturbances, particularly ptomain poisoning and other poisons ingested with the food as in botulism, where the offending organism is found in canned foods, other poisons, such as alcohol, tobacco, lead, carbon monoxid gas, snake venom and certain drugs, as atropin, morphin and gelsemium, cause motor disturbances of the eyes.

Disease of the accessory sinuses of the nose, particularly the ethmoids and sphenoids, are the cause of paralysis, thru orbital involvement usually. These cases are characterized by the implication of a single muscle usually, and most of them clear up, except where a severe cellulitis or orbital abcess is present. Cases may, however, occur in which meningeal or brain lesions due to the sinus disease may be the cause of the oculomotor disturbance.

Occasionally an operation on the frontal sinus, such as the Killian operation, may be the cause of a paralysis of the superior oblique thru injury to the pulley or the muscle itself, or the superior rectus may be injured by the same operation.

Of the long list of causes given, the ones most frequently encountered are syphilis, tabes, multiple sclerosis, exposure to cold, traumatism, meningitis, tumors and abscess of the brain, arteriosclerosis and aneurysms producing pressure or hemorrhage. Less frequent are general paresis, diphtheria, influenza, alcoholism, especially as inducing polioencephalitis, and encephalitis lethargica.

A sudden developing paralysis is usually due to exposure to cold, traumatism, hemorrhage, embolism or thrombosis. Incomplete, temporary and fluctuating paralyses are particularly char-

acteristic of tabes, general paresis and multiple sclerosis; particularly in the early stages. Abducens paralysis is found very frequently from trauma and from almost every organic disease which attacks the central nervous system, and from all sorts of toxemias and infectious diseases.

Third nerve paralysis, more or less complete, is often due to syphilis, abcess and tumors of the brain, including hypophyseal disease, and to aneurysm of the internal carotid. Paralysis of isolated branches of the third nerve is found especially in tabes, syphilis, herpes zoster, often in traumatism, and may be congenital. Ptosis, without involvement of the other external eye muscles, is of special diagnostic importance. Bilateral ptosis is often congenital. A gradually developing bilateral ptosis in the aged, unassociated with any other evidence of nerve disease and without any assignable cause, is often due to senile degeneration. A transitory, incomplete ptosis is characteristic of early tabes, or at least is a very frequent manifestation. It is rare in multiple sclerosis. It is seen as an initial symptom of chronic progressive ophthalmoplegia. It is frequently seen in cerebral softening, in cerebral abscess, particularly of otitic origin, and of the temporal lobe on the same side as the ptosis.

Here it is often associated with paresis of the opposite side of the face and arm. The same condition may be associated with tumors of the brain. It is not uncommon in cerebrospinal meningitis. It is occasionally seen in cerebral hemorrhage after injury affecting the eyelid directly, or occasionally from fracture of the base, producing intracranial lesion.

As evidence of a cortical lesion of the opposite side.

In hysteria, usually bilateral.

In ptomain poisoning associated with mydriasis and loss of accommodation. A bilateral, incomplete ptosis, slight in the morning, increasing markedly in the evening, is characteristic of myasthenia gravis.

Ptosis associated with abducens paralysis alone is very frequent in tabes.

Total ophthalmoplegia is most frequently due to syphilis, tabes, especially the later stages, orbital disease and traumatism. It is very rare in general paresis, diphtheria, influenza and the encephalitis which follows or accompanies it. Ophthalmoplegia externa occurs often in syphilis, in tabes and in various basal and nuclear disease. It is usually bilateral in polioencephalitis superior and the chronic progressive ophthalmoplegia of Graefe.

This latter condition is an extremely chronic affection which often begins in childhood and affects very gradually one muscle after another, until after many years the picture of a more or less complete ophthalmoplegia exterior is produced. The interior muscles are never affected, and no other sign of disease of the nervous system ever develops subsequently. The affection is always bilateral, but it may be arrested in any stage of its course.

Another variety of ophthalmoplegia which has quite peculiar characteristics is the socalled ophthalmoplegic migrain. This is a form of migrain which is characterized by paralyses which are a sequel of the migrainous attacks, consequently are of a recurrent nature, the muscles involved being usually those supplied by the third nerve, but occasionally those supplied by the fourth and sixth nerves.

The attack has two periods. First, the period of pain; second, the period of paralysis.

The pain begins suddenly upon one side and is centered about the eye; scotoma scintillans and hemianopsia are usually absent. The pain increases in severity, sometimes for several hours and sometimes for several days, and is usually terminated suddenly by an attack of vomiting. As the pain and vomiting subside, the paralysis begins. The palsy is an ophthalmoplegia, and is usually confined to the third nerve, being complete and affecting all of its branches, both external and internal. The period of paralysis lasts much longer than the period of pain, and may even continue for weeks. The disease usually appears in childhood, and recurs at varying intervals from a few weeks to a number of years. The cases

seem sometimes to develop out of the ordinary ophthalmic migrain. They usually recur, on the same side, but have been known to shift from one side to the other.

In a few of the cases reported, a paralysis of one of the branches of the third nerve has been left permanent after years of the regular periodic attacks. However, in the great majority of cases, chronic progressive ophthalmoplegia forms a part of a more general process, e.g., of tabes or dementia paralytica, and is frequently associated with progressive bulbopontine degenerations of the motor nuclei, and at times with spinal cord lesions of similar character.

Conjugate paralysis and spasm paralysis of lateral movement is caused by lesions in the cerebral cortex, the subcortical association paths or the tracts connecting the cortex with the oculomotor and abducens nuclei in the pons or the cerebellum. The localization of the offending lesion depends upon the other nervous disturbances manifested aside from those of the eyes.

### TREATMENT.

The treatment of oculomotor paralyses must, first of all, take into account the etiologic diagnosis. In this respect, syphilitic, and the socalled rheumatic paralyses give the best prognosis. In the former, the energetic use of iodids, mercury and salvarsan is indicated, and in the latter the use of salicylates and the free elimination by the use of Turkish baths and free use of water internally frequently accomlishes very satisfactory results. In addition to this, if the cause appears to be a focal infection, it should be removed if possible, and general tonic treatment instituted to increase nutrition and assimilation.

The accompanying disease should be treated, and if the paralysis is due to any form of poisoning, the source of the poisoning should be removed and elimination encouraged, and electricity and exercise used in selected cases. It should be remembered that the condition is always a somewhat chronic one and considerable time will always elapse before recovery takes place, even in the favorable cases. Where the paralysis is due to hemorrhage and pressure, iodids frequently seem to accomplish satisfactory results, but a long time is usually required even in the favorable cases. Indeed, it seems that time does more for these cases than anything else. Some of the cases are, of course, incurable, and particularly those which accompany the organic nervous disease have a bad prognosis.

In some of the old cases in which contracture of the antagonists has set in, we can get a result only by operative treatment which may be (a) advancement of the paretic muscle itself, recommended particularly in cases of incomplete paralysis; (b) advancement of another muscle in the same eye, especially where the obliques are affected; (c) tenotomy of the direct antagonist in the same eye (where contracture is well marked); (d) tenotomy of the associate muscle in the fellow eye; and in many cases a combination of several of these operations may be required. Various means to relieve the diplopia may be used, depending upon the individual case.

# NOTES, CASES, INSTRUMENTS

## A CASE OF SARCOMA OF EYELIDS.

JAMES A. FISHER, M.D.

ASBURY PARK, N. J.

The subject of sarcoma of the eyelids is not such a rare condition that it needs exhaustive research before reporting a case, but the case that came under my observation was rare to me as all four lids were involved. There was also a metastasis beneath the angle of the jaw on the right side. The sarcoma had also gone down thru the left antrum and thru to the roof of the mouth on the left side.

Fig. 1. Spindle cell sarcoma of eyelid showing enormous swelling in both lids. Globes atrophied by pressure.

Fig. 2. Radiogram showing involvement of left antrum penetrating thru roof of mouth. Broken line shows extent of tumor.

The patient, Mrs. R—, age seventy-seven, presented herself at my clinic at the Spring Lake Hospital, New Jersey, about the middle of October, 1922. The growth was first noticed by her six years ago, on the upper lid of the right eye, at which time she consulted an oculist. He told her it should not be removed or tampered with. From that time to the present she has seen various medical men, mostly general practitioners.

The probable reason for the neglect of the case in the first instance was the fact that the right eye at that time was a cataractous eye. Three years following the development of the tumor in the right upper lid the left lids showed tumorous growths of the same character. The tumors on the left lids, however, have grown much more rapidly than those on the right and are now more than double the size of those on the right.

The intense pressure of the tumorous mass has practically caused

atrophy of the eyeball so that now there is only a phthisical globe in each orbit. In the case of the left side ulceration has occurred with occasional hemorrhages.

By her consent we were able to obtain photographs of the condition and X-ray plates. We were also enabled to excise a portion of the tissue from beneath the left upper lid for microscopic examination which showed spindle cell sarcoma.

No effort was made to remove the tumor surgically as the involvement was so extensive that it would have probably been her death warrant.

## EMBOLISM OF CENTRAL RETINAL ARTERY—PARACENTESIS.

BEN WITT KEY, M.D.

NEW YORK, N. Y.

Mrs. G. R., aged 45 years, called to see me about ten o'clock on the morning of October 6th, 1923. She had awakened the same morning to discover that she was totally blind in the left eye. She suffered no pain and could offer no explanation for sudden blindness occurring overnight. Her previous medical and social history were of no importance.

On examination the ophthalmoscope revealed the typical picture of embolism of the central artery of the retina. It had evidently occurred only a few hours previously, for the arterial trunks were collapsed, and fine drops of blood at intervals in the vessels could be observed to push forward a little with each synchronous radial pulsation. The veins were full. One small hemorrhage appeared just off the first branching of the inferior arterial trunk. The entire fundus was edematous with corresponding loss of color. The foveola region was "cherry red."

As soon as the necessary instruments could be sterilized, I opened the anterior chamber with a keratome under a large conjunctival flap, and allowed the aqueous to escape gradually. The ophthalmoscope now revealed three small hemorrhages, one a little above the disc and two below. One of these I saw become three times as large as I observed it. This one curiously enough was present previous to making the paracentesis. No other change could be noted at this time. The eye was dressed and bandaged.

On the following day, the artery trunks were filled but attenuated, and the inferior temporal artery beyond the point of branching where the first hemorrhage had occurred, was normal in size—evidence of complete return of circulation in this portion of the fundus—an observation that can be demonstrated even at this time. Vision now was improved to the detection of shadows only. No other noticeable change could be made out.

In twenty-four hours more, there was noticeable improvement in the color of the fundus especially in the periphery—and the arterial circulation was found to be more definitely reestablished than before. She could now count fingers at two feet in the lower temporal field.

In twenty-four hours more, the edema had rapidly disappeared, and only the papillomacular region remained moderately blanched in appearance.

In the course of three more days there was no ischemia of the retina, only the cherry red spot remained. And at the end of ten days, this also had resumed a more normal color and outline. There was no cilioretinal artery present. The nervehead was now a trifle pale, with corresponding diminished capillarity, and has remained so, no advanced atrophy having taken place to this date.

Vision at this time is 20/200 (peripheral). The field of vision (presented) is very significant, a concentric contraction of 10 to 15 degrees in the temporal half, 20 to 25 degrees contraction in the nasal half, and a central absolute scotoma of 10 degrees about the point of fixation.

I present this case because it seems to illustrate that when these cases can be seen early, there is the possibility that prompt measures may partially relieve and in rare instances entirely relieve, an otherwise hopeless condition.

## A TYPE OF IRIDOCYCLITIS.

RALPH I. LLOYD, M.D., F.A.C.S.

BROOKLYN, N. Y.

Five cases of iridocyclitis have been under observation during the past year or so and three peculiar symptoms have been noted which either stamp these cases as unusual or have escaped notice by me hitherto. These three symptoms are: deep keratitis proceeding from the posterior surface of the cornea; corneal hypesthesia and corneal surface changes.

One of these cases could be called uveitis; and no objection would be offered to placing them all in that category, as the dividing line is often hazy, and cases which were placed in the milder group may later turn out to belong to the other. Of these five cases, three came under observation soon after the beginning of the trouble, in the acute stages, and the other two were first seen several months after the onset, when in the later, subacute stage. One of the older cases had four plus Wassermann reports. One of the acute cases had a positive report and one had a negative Wassermann, but her husband, seven years previously, had a four plus Wassermann and an ophthalmoplegia from which he recovered after salvarsan injections. The other two cases had negative blood tests. The specific influence is very evident in the group.

The three acute cases had the usual symptoms of very sharp iritis, plus the early appearance of an oval cloud on the posterior surface of the cornea. This oval mass was made up of material too fine to be appreciated as dots; and was not triangular like the usual cyclitic deposit, nor did it change position. Soon after this deposit appeared, the deeper layers of the cornea became cloudy and increased in opacity very rapidly. In a few days, the vision dropped to 5/200 or thereabouts, evidently because of the corneal cloud which included the pupil area at the upper end of the oval mass. There was no tendency to the formation of adhesions, but atropin was used. It was easy to show the difference in acuteness of sensation in the normal eye and the affected organ by using a wisp of cotton.

Mercurial inunctions were very efficient in the case, with a specific life partner; and iodin was equally as satisfactory for the others; one with a positive and one with a negative Wassermann. All signs of inflammation and the deposit on the posterior corneal surface cleared up soon, as in the usual severe iridocyclitis; but the deep corneal cloud was very much slower and I think some of it will remain always, in each case.

The change in corneal sensitiveness was also slow and remains for some time in a lesser degree. One of these cases passed from observation at the end of the acute stage, but the others were constant. The corneal surface change was not great in two of the acute cases but could be detected with loupe and oblique illumination. It was a loss of usual surface gloss, unevenness of the surface and faint lines. The tension was observed with fingers and no elevation detected. The ultimate vision depends upon the size of the mass on the posterior corneal surface and the location of the corneal cloud which follows it. If the corneal cloud extends well above the usual pupil area, there will be considerable interference with vision; as the cloudy area gets smaller by clearing from the periphery but the central part stays to a greater or less degree, both in size and density. Thus the vision of the case which remained under care is now 20/40 and this will probably improve somewhat.

The two cases of longer duration, came with moderate circumciliary injection; vision for large objects, because of opacity in the deep corneal layers; moderate alteration of tension, marked superficial corneal surface changes; absence of adhesions and no vascularity of the cornea. Case 3 had tension of the affected eye up to 27.5 mm. Schiötz; and 20 mm. for the unaffected eye. One of the other cases had a difference in the two eyes of five to ten millimeters, with one eye just above, and the other below, the upper normal limit. A third case (one of the acute group) had a tension at the upper normal limit for the affected eye and five or six points below this for the good eye. No atropin was used in these cases

and no adhesions formed either before or after they came under observation. The corneal hypesthesia was very marked in all of these cases and remains somewhat. It would seem that this altered sensation indicates lowered trophic influence and the surface changes are the direct result of wind and dirt acting upon a cornea with lowered vitality and lowered sensation as well.

In the older cases, which have been going about for several months without protection of any kind, there is a broad irregular elevation, semiopaque, and which looks as if a hyalin material had developed just under the epithelial layer. In two of these cases, it was located over the deposit on the posterior corneal surface, and in the third, it was transverse and half way from limbus to pupil center. One case had a pit in the center which raised the question of ulcer but there was no stain with fluorescein.

All of these eyes were protected from wind and dirt, and evidently, from this cause more than any other, clearing was prompt and complete. It is hard to believe that this can clear so thoroly and leave no surface mark behind. The opacity in the deep cornea remains in all of these cases and the vision is merely a matter of where the opacity centered Thus case 3 now reads 20/50; case 4 reads 20/100 and case 5 reads 20/70. Iodin was given to all of them and the two with positive blood tests improved more rapidly and more fully than the one with the negative report. The case with 20/50 vision has quite a number of floating opacities in the vitreous, but this is the only case in which they were found, altho they may have existed at some time in the course of the other two older cases, as atropin was not used because of tension and absence of adhesions; and the opacity of the cornea prevents thoro examining of the interior except late in the case.

The influence of the moderate tension upon sensation and corneal nutrition has been considered, but I do not feel that it can be the cause because of the presence of the lowered sensation in the acute cases without tension increase. Study of these cases suggests that the antecedent of the occasional case with more or less central, deep, nonvascular opacity of the cornea, which we find now and then among our refraction cases with one eye very much less keen than the other is an iridocyclitis of the type described.

## CASES OF FOCAL INFECTION.

T. H. Odeneal, M.D.

BEVERLY, MASS.

Paralysis of Accommodation: Mary, age 10 years. Brought into my office to be fitted with glasses. The child's teacher had sent her home with a statement that she could not read print. On examination the child could not read Jaeger 7, which deficiency was corrected by a plus 3.00 sphere O. U. The external muscles of the eyes were normal. Refraction under a cycloplegic normal, fundi normal. Further examination disclosed badly diseased tonsils which were removed that same week. In one week from date of the operation the child read Jaeger 1 without aid of glasses; and has remained well since, which is five years since the operation.

Cataract: J. P., age 46 years. Came into my clinic while I was stationed in the Panama Canal Zone, claiming the vision of the left eye had been rapidly failing for several weeks. Vision O.D. 20/20; O. S. 20/200, with correction 20/30. Examination of the left eye disclosed a complete ring of what seemed to be bright yellowish brown crystals on the posterior capsule of the lens, with some dust like opacities in the vitreous. Right eye normal. Tonsils, sinuses, Wassermann and urine negative. B. P. normal. Several abscessed teeth were extracted. Potassium iodid was given internally and dionin instilled into the eye. Three weeks from first examination vision was: O.D. 20/40, with correction 20/30; O.S. 20/200, with correction 20/50. The opacities had increased very markedly in the left eye and were gradually closing in to the center of the lens, still in a perfect ring, the vitreous remaining about the same.

The surprising thing was that there

was now an incomplete ring of the same crystals on the posterior surface of the right lens. This was no doubt a fulminant form of cataract and only heroic measures would save the sight. Another urine was requested with emphasis laid on the indican content, altho there was no history of intestinal stasis, which is rather common in the tropics, and no history of dysentery at any time. The urine was found to be filled with indican and on investigation it was found the urine had not been examined previously for indican. The patient was placed on treatment by medical service but the condition continued to progress until the left eye was practically useless and the right becoming that way.

On my advice the patient obtained a leave of absence and consulted an internist in New York, where he remained in a hospital under a rigid treatment for intestinal stasis, returning at the end of that time with the condition stationary. Vision at that time was O.D. 20/20 with correction; O.S. 20/40 with correction. The right lens had cleared while the left was partially cleared. This case is remarkable in its rapidity, and the fact that lenticular opacities can be absorbed, in this case by removing the cause, altho these were no doubt deposits and not degenerated cells. Finally the most important thing was the vision was saved.

Optic Atrophy: F. H., age 40 years. Noticed vision in right eye was becoming blurred lately. Vision O.D. 20/50, O.S. 20/20, uncorrected with glasses. Refraction normal with cycloplegic. Tension normal, convergence very weak, otherwise muscle balance normal, fundus normal, nervehead normal in appearance, central color vision normal. Concentric contraction of the field of vision 20 degrees, no scotoma. Tonsils, teeth, prostate, Wassermann, sinuses negative. Urine was loaded with sugar and indican. Vision continued to decrease slowly, notwithstanding treatment, until eighteen months afterwards the process seems to have come to a halt. At this time the vision was O. D. 20/100 unimproved with glasses.

I have called this case optic nerve atrophy for want of better terminology, altho the nervehead was perfectly normal in appearance at all times. It could not be classed as a retrobulbar neuritis. The location of the affection is problematical. The left eye was not involved.

Interstitial Keratitis: This case is reported as one of several I have had where the Wassermann was positive; but refused to heal until the focus of infection was removed.

J. L., age 20 years. Interstitial keratitis, bilateral, severe. Had been under treatment in a hospital three months where a rigid antiluetic treatment was given, consisting of salvarsan injections intravenously and mercury subcutaneously with iodids by mouth, together with atropin, dionin and hot packs for the eyes. He had been gone over thoroly for any focus of infection and the tonsils had been removed on suspicion without any lasting benefit, notwithstanding the Wassermann was now negative.

On taking over the department in which he was, I gave him parenteral injection of milk and also subconjunctival injections of salt solution, with only slight improvement, which did not last. Another thoro overhauling was given for a possible focus, but nothing was discovered. Finally the genitourinary department was requested to massage the prostate, altho there was no discharge, the urine was clear and no history of gonorrhea. A drop or two of pus was obtained from the prostate and the patient placed on irrigations and massage. Within two weeks both eyes became inactive and remained so until I lost sight of the case several months afterwards.

## MODIFICATION OF THE CALKINS MUSCLE FOLDER FOR STRABISMUS.

J. Wilbur Calkins, M.D.

OAKLAND, CALIF.

I have made the following improvement on my muscle folder (described in the American Journal of Ophthalmology, Nov., 1923) which makes

the introduction and more especially the withdrawal of the hairpin loop easier. I have found that the muscle after it has been folded about the loop tends to adhere to the metal, making withdrawal difficult.

The hairpin loop has been cut in two. Prong No. 1 is fixed. Prong No. 2 is movable and separates from the handle of the instrument. Technic of operation as modified.

Hairpin loop is slipped about the muscle with the end of loop open. Fig. A. The movable prong No. 2 of loop is turned until the curved end, in which is a hole, is opposite the fixed prong No. 1. The two prongs are then snapped together, Fig. B. The muscle is now folded and first half of knots of sutures tied. The end of loop is now separated (Fig. C), the fixed prong entirely withdrawn. Prong No. 2 is now removed and the sutures securely tied.

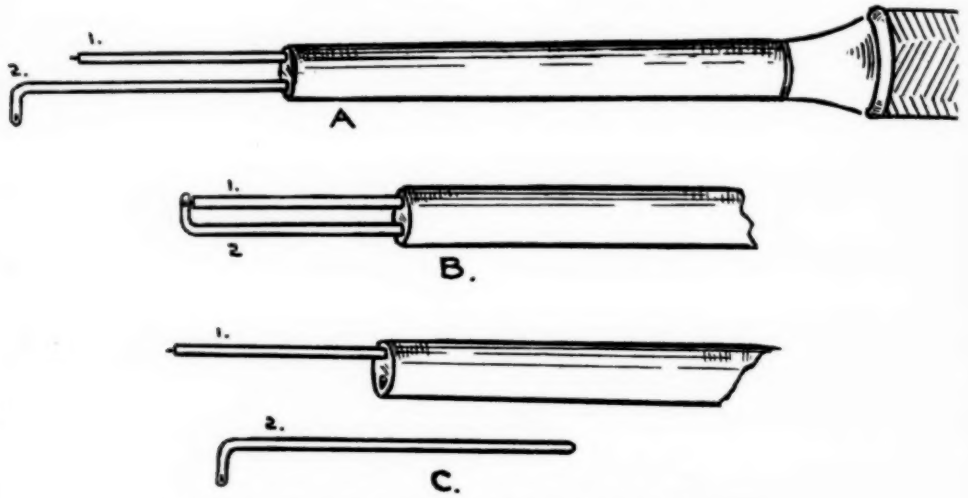


Fig. 1.—Modification of Calkins' muscle folder for strabismus.

# SOCIETY PROCEEDINGS

Reports for this department should be sent at the earliest date practicable to Dr. Harry S. Gradle, 22 E. Washington St., Chicago, Illinois. These reports should present briefly scientific papers and discussions, include date of the meeting and should be signed by the Reporter or Secretary. Complete papers should not be included in such reports; but should be promptly sent to the Editor, as read before the Society.

## CITY MEDICAL SOCIETY, BALTIMORE.

### Ophthalmological Section.

March 27, 1924.

DR. J. W. DOWNEY, Presiding.

### Calcified Nodules in Optic Disc.

DR. JONAS S. FRIEDENWALD. Hyalin nodules (Drusen) in the optic disc are quite rare. Parsons in his Pathology of the Eye has collected forty-two cases. Since the publication of his book, reports of some eight or ten cases have appeared in the literature. Recently Lauber (Arch. f. Ophth. V. 105, p. 567, 1921) has written on the subject and made an exhaustive collection of the literature bearing upon it. The hyalin bodies are described as discrete or conglomerate nodules having a laminated structure as if they had been laid down, layer upon layer, like an onion. They stain pink with eosin and, except for the lamination, are structureless. Rarely are they calcified. They occur at all ages but have been most often noted in middle or advanced life. They occur, usually bilaterally, in eyes which are otherwise healthy; but have been found, no doubt accidentally, in association with a variety of ocular and general diseases. A few have been recognized ophthalmoscopically. They are then described as clear translucent nodules which lie in the substance of the optic disc often in a ring near the periphery of the disc, sometimes causing considerable elevation of the surface which overlies them.

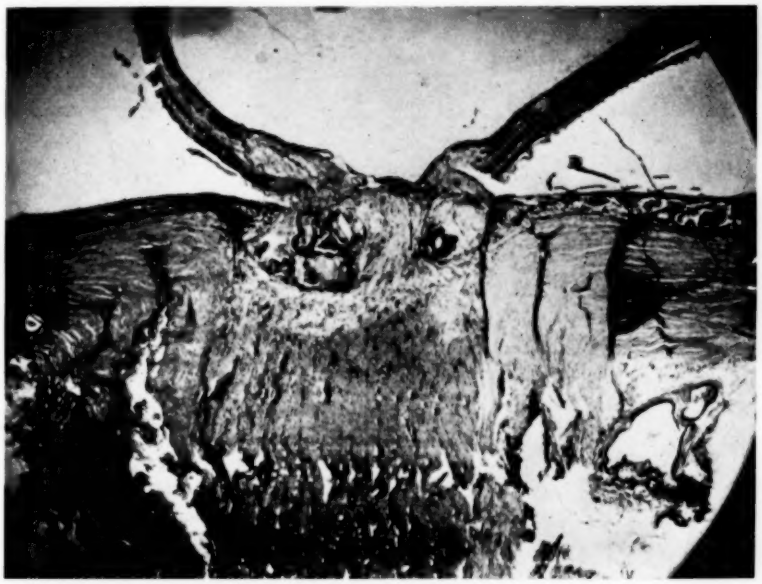

Fig. 1.—Calcified nodules in optic disc. Section thru right nervehead.

In the case to be reported, the nodules were calcified. They occurred in both eyes of a patient who suffered from a tumor of the hypophysis.

O. D. (Johns Hopkins Hospital Autopsy No. 7826) white female, 54 years of age, entered the hospital on December 13th, 1923 and died on December 20, 1923. From her hospital record I report the following: She complained of dimness of vision.

History: Patient's mother has cataract. Usual childhood infections, puberty hypertrophy of thyroid, nocturia one-three times for many years, dysmenorrhea, married twenty-nine years, no pregnancies, tonsillectomy thirty-seven years ago, otherwise history negative.

Present illness: Ten years ago she first noticed a "mantle or curtain coming down" over the upper temporal field of the left eye. During past ten years this mantle has progressed across the field of her left eye until two months ago, left eye became completely blind. Recently there has been pain in left eye, left side of face and back of the neck, also attacks of slight dizziness and dimness of vision in her right eye. She is still able to read with the right eye but fatigues easily.

Physical examination was negative, except for eyes.

Left eye: Completely blind, pupil does not react to light but reacts consensually. Ophthalmoscopic: media clear, disc white, outlines irregular, no swelling of disc. Vessels normal.

Right Eye: able to read. External examination negative. Media clear. Marked pallor of nasal half of the disc, outlines irregular, no swelling of the disc, vessels negative.

Blood count and urine: normal.

Blood Wassermann: negative.

X-ray of Skull: Sella turcica enlarged, posterior clinoids destroyed, calcified pineal gland. Tumor of the hypophysis was diagnosed and an operation was performed for its removal. At operation the left optic nerve was seen to be flattened out to a thin translucent strip, right optic nerve was apparently intact.

Fig. 2.—Calcified nodules in optic disc. Section thru left nervehead.

The patient did poorly after the operation, developed convulsions, became comatose and died.

The tumor which was removed has been reported to be an adenoma of the hypophysis. The autopsy revealed nothing additional of importance, except for secondary sex changes.

The eyes were removed at the autopsy. Their examination in the gross revealed nothing new. The left optic nerve was thin and atrophic, the right nerve appeared normal. On the section numerous discrete and conglomerate calcified nodules were found in both optic discs. They vary from one-third to one-twentieth mm. in diameter. They lie in the substance of

the optic disc. In part they are in close contact with the normal elements of the disc, in part they are surrounded by a thin fibrous or glial capsule. They are not in contact with the cribriform plate but lie a little distance inwards from this tissue, the larger ones projecting as much as one-fifth mm. into the vitreous. They are found for the most part in the outer one-third of the disc, only in a few places encroaching on the cup. On decalcification their lamellar structure can be made out. Special stain shows the nodules to be free from fat, but there are a good many fat droplets in the tissue immediately surrounding them.

The absence of lipoid material in these nodules is a point of difference between them and the colloid excrescences of the retinal pigment epithelium which always take the Scharlach R. stain.

The left optic nerve is completely atrophic as is also the nerve fiber layer and ganglion cell layer of the left retina. The right optic nerve shows an atrophy of only a few of its most nasal fiber bundles.

The "Drusen" in the optic disc are to be regarded as an anomaly, perhaps congenital, rather than as a disease. Their possible relation to the so called "corpora amylacea" found in the sheath of the optic nerve, or to the colloid excrescences of the choroid has been much discussed, but most authorities agree that there is no relation between these very different conditions.

**Use of the Bailliart Dynamometer and Its Clinical Value.**

DR. A. CLAPP stated: Bailliart and Magitot at the International Congress in Washington, April, 1922, called attention to a method of estimating the diastolic and systolic pressure of the intraocular vessels, thru a study upon the eyes of cats. Their deductions were: First that the diastolic arterial pressure is normally higher than the ocular tension.

Second: that the venous pressure is not always higher than the ocular tension.

Third: that the ratio of ocular diastolic pressure to the general diastolic pressure in cases of nearly normal B. P. is 45:100. In cases of high B. P. this ratio is 50:100. The technic consists of first finding the ocular tension with a Schiötz tonometer and with a dilated pupil to place the Bailliart dynamometer over the external rectus muscle and gradually apply pressure, watching the artery upon the nervehead until the first appearance of pulsation: the pressure then being read from their chart as published in the Amer. Journal of Ophth. (Vol. V-P. 782). In this article by Magitot, he has made the following deductions: In blurring of a nervehead due to intracranial pressure, the ratio of the local diastolic pressure to the general diastolic pressure is increased, while in the blurring of an optic neuritis or an angiosclerosis of the retina this ratio is decreased: that more value is derived from the diastolic pressure than from the systolic.

The following cases confirm Dr. Magitot's deduction:

Case I.—J. P.—Optic neuroretinitis of cardiovascular origin. Local diastolic pressure 40; General diastolic pressure 156. Ratio 40:156. This is definitely lower than normal.

Case II.—H. S.—Fundus shows neuroretinitis with hemorrhages, arteriosclerotic in type. Local diastolic pressure 45; general diastolic pressure 110. This ratio is also low.

Case III.—H. B.—Young boy with typical choked disc with diagnosis of tumor of the cerebellum. Local diastolic pressure 60; general diastolic pressure 70. Ratio 60:70. Marked increase in ratio.

Case IV.—J. L.—Choked disc from intracranial tumor. Local diastolic pressure 40; general diastolic pressure 80. Ratio 40:80. Ratio increased.

Case V.—B. C.—Case of elevated nervehead with some hemorrhages and exudates. Diagnosis not conclusive some maintaining that it is an optic neuritis, while Dr. Dandy thinks choked disc. Local diastolic pressure 50; General diastolic pressure 70. Ratio 50:70. This ratio is increased.

While this case has improved without treatment in the last two years the

evidence of Magitot's contention would indicate increased intracranial pressure.

I am unable to form a definite conclusion as to the value of this instrument from a clinical standpoint. In the cases cited it certainly has confirmed Magitot's findings. We are following these cases and hope that it will be a means of differentiating between the questionable cases of optic neuritis and choked disc.

C. A. CLAPP,
Secretary.

## THE NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNOLOGY.

PRESIDENT, DR. E. B. CAYCE,

APRIL 21, 1924.

**Acute Neuroretinitis.**

DR. HILLIARD WOOD. Mrs. R. H. S., aged 42, first consulted him on April 14, 1924. One year ago she had complete hysterectomy by Dr. W. D. Haggard. Tonsillectomy 8 years ago. For the past week vision of left eye has been blurred.

Examination: corrected vision R.= 20/15. L. V.=20/30. Accepts no lens.

Right eye: Presents no pathology, only a venous pulse confined to the disc.

Left eye: Presents no pathology externally. Pupil dilated with homatropin. Lens and vitreous normal. General fundus best seen without lens. Optic disc best seen with +2.00 D. S. Disc swollen, blurred in outline, and covered over largely with fresh hemorrhages. These hemorrhages are worse on the disc but extend outward in every direction in the retina for 2 or 3 disc diameters, being more or less linear. No definite retinal maculae. Urine negative. Diagnosis left eye: Acute neuroretinitis. Blood Wassermann negative. Teeth and paranasal sinuses negative to X-ray. Good result from tonsillectomy. No definite cause found for the neuroretinitis.

Treatment: Mercurial ointment 50 per cent, grains XXX daily.

Treatment: K. I. in increasing doses. Rest of eyes. Smoked glasses. Vegetable diet.

Dr. Wood emphasized the importance of the alimentary canal as a focus of infection, recalling that Billings placed it fourth, his order of sequence being tonsils, teeth, sinuses, and alimentary canal. He has been much interested, however, in a recent article about such cases, inflammations about the fundus, in which article the writer gives the alimentary canal third place, the sources of focal infection named in the order of their importance being tonsils, teeth and alimentary canal. During the past few months Dr. Wood has had an unusually large number of fundus cases and in the treatment of them he has adopted the ideas set forth in this article, viz, elimination of meats, a fruit and vegetable diet, and keeping the bowels open. Some of these cases have seeemed to improve more readily under this treatment than before.

*Discussion.* DR. EUGENE ORR emphasized the fact that this is a desperate condition and requires radical treatment. In the absence of other pathology which might account for the trouble he would not hesitate to open the posterior ethmoids and sphenoids.

DR. M. M. CULLOM, like Dr Orr, thought it well worth while to investigate the ethmoid and sphenoid cells as the patient stands a chance of losing her eye unless something is done. In his opinion every effort should be made to find the cause. He believes that the X-ray and transillumination are of little help in ethmoid and sphenoid disease. He has known X-ray reports to be sent in with the notation "ethmoids negative," when the ethmoid region was packed with polypi and pus could be seen exuding. It had occurred to him that what many are attributing to the alimentary canal is simply pus that has been swallowed from some source above, the tonsils, teeth, or sinuses; and what they are attributing to the alimentary canal as a primary focus is in all probability a secondary focus. As an illustration of this he mentioned the fact that after the practice of enucleation of tonsils had been started, when questionnaires were sent out some time afterwards to find out how the patients were,

quite a number of them stated that they had suffered with gastrointestinal troubles which had all disappeared after the tonsils were removed. He does not believe, therefore, that the alimentary canal itself is liable to be the focus in a primary sense, but more likely a secondary focus.

Dr. Fred Hasty recalled a case in which a search was made for the cause of an eye condition. The X-ray gave only a suspicion of shadow on the affected side. Upon going into the ethmoids and sphenoids an unusually large sphenoid was found which was filled with a white gelatinous material. After seeing the substance he was not surprised that the X-ray had failed to show a shadow. In his opinion one is likely to fail to find pathology in a great many cases of sinus infection; simply because the infection is of such type as will not obstruct the transmission of light by transillumination, or the X-ray. While he does not advocate the ruthless opening of sinuses merely on chance, yet in a case like the one under discussion he believes one would be justified in doing so.

Dr. Wood (closing) expressed appreciation of the ideas which had been advanced. He had taken for granted that the sinuses were negative because of the negative findings. However, he will investigate more carefully the condition of the sinuses. So far there has been no operation of any kind.

**Sympathetic Ophthalmia.**

Dr. Herschel Ezell. Mr. J. M. S., aged 70, first consulted him March 4, 1924 giving the following history: The right eye has been blind for 8 years. The patient was told then that he had iritis and intraocular hemorrhage. The eye has been quiet since until a month ago at which time it became very painful. The left eye has never given the patient any trouble until the last two or three weeks, when it developed photophobia and lacrimation.

Examination: Right eye blind. Cornea hazy. Pupil somewhat contracted. Iris of muddy color, bound down at pupillary margin, and bulging between the margin and the periphery (iris bombé). White spot in center of pupil due to organized lymph. Fundus cannot be seen. Eye deviated slightly upwards and outwards. Tension greatly increased by fingers.

Left eye: Vision 20/40 with glasses. No fundus changes noted.

Diagnosis: Right eye, iridocyclitis.

Treatment: atropin and argyrol for right eye.

March 17.—Patient has instilled atropin in the left eye thru error. Refracted the eye and with + 1.00 D. S + 0.50 D. C. Ax. 180°, vision 20/40 Fundus shows a small red streak in

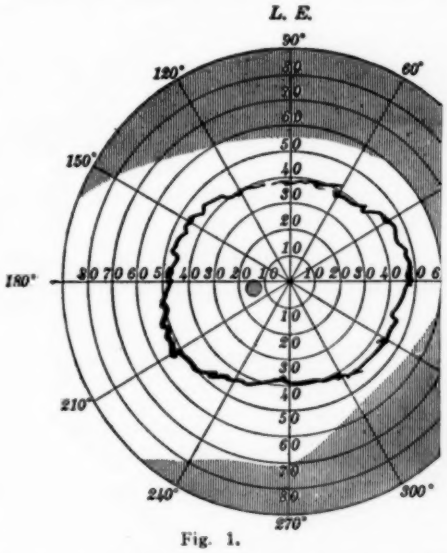


Fig. 1.

the macular region. Tension with Schiötz tonometer shows right eye tension 64 mm. mercury, left eye tension 33 mm. mercury. Left visual field contracted. (See chart).

Diagnosis: Right eye—Chronic iridocyclitis. Iris bombé. Left eye—Beginning sympathetic ophthalmia.

*Discussion.* Dr. Robert J. Warner does not believe that the condition in the left eye could be quite considered as sympathetic ophthalmia, as the symptoms are hardly plastic enough. He advised immediate enucleation of the right eye and forced myotics in the left.

Dr. Hilliard Wood concurred in Dr. Warner's suggestions as to treatment.

Dr. Ezell (closing) stated that while the condition was not advanced, he believed it to be one of sympathetic ophthalmia in view of the hemorrhage

and the irritative symptoms which are present.

**Acute Serpiginous Ulcer.**

Dr. Robert J. Warner. R. J., age 14. Previous history negative. Feb. 14, 1924 struck left eye with corner of pillow. Had slight pain which soon ceased. Case first seen Feb. 15, 1924 at which time there was a small corneal ulcer of the left eye. The eye was anesthetized, atropin instilled, ulcer cauterized with tinctur of iodin, and eye bandaged.

The following day there was a definite hypopyon keratitis, the ulcer was more marked, and there was slight bulging of Descemet's membrane. The patient was sent to the hospital, where culture of eye showed pneumococci and streptococci. One thousand units of diphtheria antitoxin given Feb. 15th and 16th. Drops, 1 per cent optochin, and 1 per cent atropin sulphat instilled every two hours, alternating with 20 per cent argyrol every two hours. The Descemetocele perforated Feb. 15, 16, 21 and 22. The secondary iridocyclitis was very marked tho the patient had unusually small amount of pain in this eye. The cornea was partially anesthetic.

Patient left the hospital after being there six days, and the same treatment was continued at home for one week. The pupil dilated well after about two weeks time,,but there was a small posterior synechia until then. On March 1 the treatment was changed to atropin 1 per cent, dionin 2 per cent used every two hours and hot moist compresses of fifteen minutes duration three times daily. The patient is using this treatment at the present time. The iridocyclitis is very much improved, the cornea comparatively clear, except at the site of perforation. The anterior chamber is well formed and the pupil is well dilated. An interesting point in this case is that the ulcer perforated four times and there was neither intraocular infection, permanent iris incarceration, nor lens injury.

Dr. Warner asked the gentlemen what their experience had been in the use of antitoxins in these cases. Many are now reporting the use of diphtheritic, autogenous, or pneumococcic antitoxins. In this case two doses of diphtheritic antitoxin were given and the patient immediately afterwards began to show marked improvement. Whether this might be attributed to the effect of the antitoxin, he could not say.

*Discussion.* Dr. Hilliard Wood brought out two interesting points in connection with this case: (1) Serpiginous ulcer has in his experience been rare in the young, being much more common in the old. (2) The fact that this ulcer healed and left as good a result as it did. It is remarkable that as good an eye could have been obtained as was obtained. Referring to the fact that there had been four perforations without intraocular infection, he believed the explanation to be that when there is a perforation there is drainage of aqueous forward and the current of aqueous coming out washes the infection away from the wound rather than draws it in. When it closes so that the aqueous cannot be drained out, of course the infection cannot go in.

Dr. E. B. Cayce said that he had been in the habit of using foreign proteins by subconjunctival injections of the cyanid of mercury. Just what influence the reaction of the foreign protein has, he cannot say, but he has had some very happy results. This patient is to be congratulated upon the wonderful result obtained by Dr. Warner, as it is hard to conceive how he could have that much infection extending thru Descemet's membrane without permanent adhesions.

**Intraocular Foreign Body.**

Dr. Warner showed Mr. B., aged 35, who on April 15, 1924 while working on a boiler was struck in the right eye by a piece of metal. Immediately following the injury there was loss of vision in the right eye, which gradually improved the day following, but did not return to normal. There was slight pain in the eye and he could not see anything to the left out of this eye. Examination April 17, revealed the following:

Right eye: Vision 20/100. Lids

normal. The cornea contained a small scar at the upper temporal side at the limbus. The sclera showed injection. The anterior chamber was normal. The iris reacted poorly to light and contained a small cut directly back of the corneal scar. The lens was negative. The vitreous contained numerous opacities and blood clots. The retina was detached on the temporal side. Field of vision markedly contracted on the nasal side.

X-ray examination showed a small foreign body located 4 mm. above the horizontal plane, 10 mm. temporal side vertical plane, and 17 mm. back of center of cornea. This locates the foreign body in the posterior wall of the eyeball, and an attempt was made to remove it with an electromagnet, which was unsuccessful.

*Discussion.* Dr. Wilkerson stated that while this was a case in which it is difficult to decide what should be done, yet the chances are that the eye will never have sufficient vision to warrant taking the risk of leaving it in. In his opinion enucleation is advisable.

Dr. J. Leslie Bryan remarked that these cases are always interesting, as it is always a question as to what should be done where one has a case of foreign body in an eye with as much vision as this man has. Dr. Warner stated that at the time he saw the patient in his office the vision was 20/100, but tonight he can only count fingers at ten feet. He has quite an extensive detachment, and of course contraction of the pupil. The probabilities are that if this eye is not removed it may be a source of trouble in the future. While he dislikes to remove an eye with as much vision as this one has, yet he believes the vision will be further reduced and in the course of a short time the eye will have to be enucleated.

Dr. Fred Hasty presumed this to be a compensation case and asked information on the following point: If it is decided to leave the eye in and settlement is made, and some years later the patient develops sympathetic ophthalmia, what will be the situation then so far as compensation is concerned?

Dr. W. G. Kennon said that to him what to do with a seeing eye constitutes a most serious problem, especially in those very early cases of intraocular sarcoma. He recalled a case of intraocular sarcoma in which Dr. Weeks removed an eye which had 20/20 vision. Personally he cannot quite make up his mind to remove an eye which has a reasonable amount of vision. In this case he would advise that another X-ray be made to determine whether the foreign body has moved, and if not, then the magnet should be tried again. If this fails and the eye then continues to grow worse, he would advise enucleation.

Dr. J. J. Frey agreed with Dr. Kennon as to the advisability of postponing enucleation, as the foreign body might possibly be sterile and might not cause any further trouble.

Dr. M. M. Cullom has seen some sad results from leaving a foreign body in the eye. If there is surely a foreign body in the eye and it has not been removed, the wise thing to do would be to take the eye out, rather than risk having a blind man on hand.

Dr. Robert Sullivan stated that his understanding was that in a compensation case where enucleation is advised and the report so handed in to the insurance company, upon refusal of the patient to submit to the operation a settlement is made upon the basis of vision then remaining, and this settlement is final. If later the patient loses the injured eye, or the other eye thru sympathetic opththalmia, it is his own misfortune as he has previously been advised the right thing to do and has refused.

Dr. Hilliard Wood does not believe that one failure with the magnet should be final, but that it should be used a second time because the magnet may have moved the foreign body from where it was before it was used at all. Another X-ray should be made and the foreign body relocated before a second attempt is made, and if it is located where one can get to the outer side of the eye, one can make an open-

ing in the sclera, and choroid if necessary, and any giant magnet should draw it out. To make an opening in the sclera back of the ciliary region is ofttimes preferable to drawing the foreign body around the lens thru the iris or pupil and then making a corneal incision and removing it. He has more frequently taken them out thru the cornea, but he believes an opening in the sclera will give better vision in the end and less trauma to the ciliary region, lens, and iris than removing it in front.

Dr. Warner (closing) stated that the foreign body might possibly be of a type which would not be attracted by the magnet. With the first attempt there was no increased pain in the eye when the magnet was turned on. He first placed the magnet over the site of entrance, without effect, then to one side directly over the foreign body, but there was no bulging and no increased pain.

HILLIARD WOOD, M. D., Editor.

## CHICAGO OPHTHALMOLOGICAL SOCIETY.

FEBRUARY 18, 1924.

DR. J. BROWN LORING, President.

### Traumatic Paralysis of Both Sixth Nerves.

DR. G. W. BOOT presented a young girl with the following history: She was going home on November 10th last, and was struck by an automobile. When she recovered consciousness, she complained of double vision, and upon examination paralysis of both sixth nerves was found. She could not abduct either eye beyond the median line. No lesion of any other cranial nerve could be found. The X-ray showed no skull fracture. She complained of dizziness, but the hearing was normal. She wore a patch over one eye to avoid the double vision.

After about eight weeks, she began exercising the abductors with the Worth amblyoscope. At first the best she could do was 30 degrees of convergence, but this was gradually improving. Dr. Boot's theory was that there was a small hemorrhage into the floor of the fourth ventricle, which caught the nuclei of both sixth nerves. It must have been comparatively small, not to catch other nerves. The outlook for complete recovery was favorable.

In connection with this case, he told of a boy of about ten years of age, who, while walking backward on the railroad track, stumbled and fell, striking the left mastoid on a tie. The next day he was brought in on account of the double vision. Paralysis of the left sixth nerve and a herpes on the left lower lid was found. In this case, the explanation was that the force of the blow was transmitted along the petrous bone to the tip where the sixth nerve crosses. In this location is also the Gasserian ganglion. A small hemorrhage into this area could cause paralysis of the sixth nerve and enough irritation of the ganglion of the fifth nerve to give rise to the herpes.

*Discussion.* DR. ROBERT VON DER HEYDT questioned the diagnosis in this case of so called double abducens paralysis. He did not think it could be so easily explained on an anatomic basis. It was probably a convergent spasm, and he was inclined to think it a case of hysteria. These were not uncommon. He had presented two cases of hysteric convergent spasm before the Infirmary Society at one time. He would like to have other opinions in this case.

DR. GEORGE W. MAHONEY did not agree with Dr. Von der Heydt. He had seen, within a few weeks, three different times, a case of a boy, 13 years of age, upon which he had been called in consultation. This boy had received, as the X-ray plate showed, a vertical fracture of the skull on the right side, a little anterior to the center. He had paralysis of both sixth nerves. Under treatment he had completely regained control of the left sixth, but absolutely no improvement of the right sixth nerve. Dr. Mahoney was very sure there was no element of hysteria in this case.

DR. JULIUS GRINKER stated that it was not unusual to find a hemorrhage

in one sixth nucleus. The unusual feature in Dr. Boot's case was its bilaterality. He could not conceive how this could be explained by spasm. The mere fact that the patient was slowly recovering would indicate slight hemorrhage rather than hysteria.

Dr. J. F. Burkholder said that there could be a little hemorrhage between the nuclei of the sixth nerve, and it would require very little exudate to put these nerves out of business. Two nuclei are practically together, very often. The nuclei of the cranial nerves being very soft in texture, a very little pressure, such as an exudate or hemorrhage, would interfere with the function of the cells. On the other hand, the facial nerve, lying right close to the sixth nerve nucleus, being a very strong, tough nerve covered by a thick epineurium, would require a great deal of pressure to interfere with its carrying nerve impulses.

The hypothesis regarding these tracts was laid down years ago, but during the past few years men had proved that there was a tract between the sixth and the third nerve. A stimulus coming to the sixth nerve would mean abduction of the eye to that side.

**Osteoma of Orbit.**

Dr. Thomas A. Allen presented a case for Dr. W. H. Wilder. According to the history, on the 14th of January, 1924, he came to see Dr. Wilder because of a growth in the right orbital region, in the region of the trochlea, which had been present for about one year. This had grown so that it caused a slight displacement of the eye and slight ptosis of the upper lid. It had grown rather rapidly in the past four months. There was no pain, even on pressure. On palpation, there was found a hard mass in the upper nasal portion of the right orbit; firmly attached to the bone, and about one and one-half cm. in diameter. It seemed somewhat nodular.

Vision was 20/30 each eye. History practically negative. Wassermann negative. The X-rays, which were shown, revealed a density in that portion of the orbit. Fields were not taken until after the operation.

On the first of February, under general anesthesia, a Killian orbital incision was made over the right supraorbital ridge and the mass dissected out. The picture of the mass showed it about one and one-half times its size. There was a small polypoid growth apparently on the under side. The part of the bone which had no polypoid growth was toward the front, and it had a little nubbin which extended into the frontal sinus. It was necessary to dissect off the trochlea of the superior oblique. In the course of the operation, the mass was found to be larger than had been thought, and it was necessary to pull the eye downward and outward and work back with heavy forceps, and thus it was gradually broken off. The polyp was taken out of an anterior ethmoid cell. The cerebral cavity was apparently not entered, nor was the antrum entered. The patient had never had optic neuritis, and the vision had consistently been the same—20/30. Since the operation he had complained of diplopia, and the fields of diplopia showed the largest amount of diplopia in the field controlled by the right superior oblique. It showed torsion in the right lower field, and vertical diplopia was present in the left lower field. This was decreasing in amount, and bothering him less than it did at first.

*Discussion.* Dr. E. V. L. Brown. The nodular and strand like appearance of the mass reminded him of the condition found in a case of neurofibroma of the orbit reported some years ago by Dr. Charles H. Beard and himself.

**Adherent Leucoma.**

Dr. A. H. Pember presented a man, age 20, who entered Cook County Hospital on the service of Dr. Darling. At the age of eighteen months, he fell upon a piece of glass, cutting thru both upper and lower lids of the right eye, and perforating the cornea. An adherent leucoma resulted, for which the patient now sought treatment. The pupil was 1 mm. in size, irregular, and would not dilate under the usual atropin therapy. Vision was O.D.=O.2, O.S.=1.5. At the suggestion of Dr. Darling, two Lange knives were made at Mueller's to free the adherent iris

from the posterior surface of the cornea. The principle of these knives was to allow no aqueous to escape while severing the adhesion. The first knife was no more than an ordinary dissection knife with a slender shaft and a sharp point. The second knife had a larger shaft and a ball point. With knife No. 1, taking a vessel in the conjunctiva as a landmark, the cornea was pierced about 2 mm. from the limbus and quickly withdrawn. Knife No. 2 was then placed in the puncture and carried to the adhesion. The larger shaft of Knife No. 2 allowed no aqueous to escape, and as it had a ball point, there was no injury to the cornea. The first attempt, altho no aqueous was lost, was unsuccessful. As there was no reaction, a second attempt was made three days later. This was partially successful, but at the end of one week the pupil was 2 mm. in size. When the eye again quieted down, the pupil was entirely freed, and was found to be 4 mm. in size. Under atropin the vision was 0.4 in the affected eye.

**Anatomy of Nuclei of Third, Fourth and Sixth Nerves and Their Association.**

DR. J. F. BURKHOLDER. Your president asked me at the beginning of his term to give a talk on some nervous problems, and I suggested the third, fourth and sixth nerves. He did not like the title, and I suggested the anatomy of the third, fourth and sixth nerves and their association. This seemed to please him, but on further consideration I thought the proper title would have been the Anatomy of the Posterior Longitudinal Bundle. This is a very important tract, and few works on ophthalmology or otology pay sufficient attention to it. It is one of the oldest tracts, phylogenetically speaking, that is laid down in the central nervous system. It is a tract that brings into association the spinal cord, the cranial nerves and the subthalmic region.

In making a transverse section of the cord in the cervical region, anatomies tell us that arch'ng over the anterior horn of gray matter, there is a bundle of white fibers called the anterior basis bundle. This continues up into the brain stem, and becomes the posterior longitudinal bundle, being a direct tract between the upper portion of the spinal cord, the third, fourth and sixth nerves, the accessory nerve and Deiters' nucleus, which, as we know, is intimately associated with the semicircular canals of the labyrinth. On the posterior surface of the cord are three large fasciculi, the innermost one called the fasciculus gracilis, the other the fasciculus tunealis. The fibers constituting these tracts are carried up to the medulla oblongata and into nuclei of the same name. The cells in these two nuclei send their axons across the middle line to the opposite side, forming a large tract called the fillet or lemniscus. These fibers lie ventral after they cross the middle line, and are continued up to the subthalmic region and the midventral aspect of the brain stem. On the ventral surface toward the brain, there is the motor decussation of the pyramids. In the medulla oblongata, these lie in front and are two prominent bundles on each side of the midline. They represent fibers that come down from the Rolandic area of the cerebral cortex. This decussation is called the inferior or motor decussation, and when they cross thru to the opposite side of the cord, they cut off the head of the anterior horn of gray matter, which gets pushed to one side and becomes the nucleus lateralis. At the same time, the anterior basis bundle gets pushed up to the floor of the fourth ventricle by this motor decussation and the decussation of the fillet.

The central canal of the spinal cord, when it gets up in the lower portion of the medulla oblongata, opens out, as it were, like the unfolding of a leaf, and this opening out constitutes the fourth ventricle. This central canal is continued up as a groove called the mesial longitudinal sulcus, and on either side of this mesial groove there are certain locations that mark the deep origin of the sixth, seventh, ninth, tenth, eleventh and twelfth cranial nerves. Quite at the lateral border of

the fourth ventricle, just below its center, there is quite a large elevation, easily seen with the naked eye, which is called the area acoustica, and marks the nucleus of the vestibular branch of the auditory nerve. The cells constituting this nucleus are arranged in three groups. The lateral group, perhaps the nucleus of Deiters', the mesial group, and the superior group.

Many of the cells of this vestibular nucleus send axons toward the middle line, but before reaching it they divide like the capital letter T, one branch running up in the posterior longitudinal bundle and one branch running down into the spinal cord. These axons are very numerous, and in passing down to the cord and in the cord, are arranged in two bundles that are called the lateral spinovestibular tract and the ventral spinovestibular tract. The branch that runs upward in the posterior longitudinal bundle may send filaments to the nucleus of the accessory nerve, the nuclei of the third, fourth and sixth nerves. Axons from other cells in the vestibular nucleus pass over to the opposite side, divide like the capital letter T, and have the same arrangement as those I have just described.

As I said before, many of the fibers of the posterior longitudinal bundle are carried up into the subthalmic region of the brain and are there in the interstitial nucleus. This nucleus lies anterior to the nucleus of the third nerve and the red nucleus, and some anatomists claim that this interstitial nucleus ought to be called the nucleus of the posterior longitudinal bundle. As the fibers from the anterior basis bundle of the cord are carried up to the subthalmic region, they also send filaments into the accessory nerve and nucleus of the third, fourth and sixth; so you see there is a very intimate association between the nuclei of the extrinsic eye muscles, the spinal cord and the vestibular nucleus.

Let me say a word about the origin of the cells that constitute the motor cells of the cranial nerves. In the cervical region of the spinal cord, the motor cells lie in the anterior horn and are arranged in two principal groups, one lying in the mesial aspect of the anterior horn and one lying in the lateral aspect of the anterior horn. The cells in these groups are carried in this relationship right up thru the brain stem. The mesial group, as they are carried upward in the brain stem, form the nuclei of the hypoglossal and the sixth, fourth and third cranial nerves. The lateral group form the nuclei of the eleventh, tenth, ninth, seventh and motor cells of the fifth nerve. The mesial group of nuclei lie immediately under the floor of the fourth ventricle, except the third nucleus and the upper part of the fourth nucleus. Some anatomists who have dealt with the physiology of the extrinsic muscles of the eye place the third nerve nucleus in the floor of the fourth ventricle. This is clearly a mistake, because even in the lower vertebrates the third nerve lies ventral to the aqueduct of Sylvius.

The sheep's brain makes very fine anatomic material for studying these structures with the naked eye. These brains, hardened in 10 per cent solution of formaldehyd, can be kept indefinitely, and many of the structures of the brain stem, such as the auditory nerve, the course of the seventh nerve thru the brain stem, the posterior longitudinal bundle, the red nucleus, etc., can be seen with the naked eye. In fact, all the structures that are found in the human brain stem can be found in the brain stem of the sheep, and many of them, such as the trapezium, can be identified more easily in the sheep than in the human specimen.

In continuing the posterior longitudinal bundle above the fourth ventricle in the brain stem, it lies immediately ventral to the nuclei of the third and fourth nerves, so that anatomically the association is very intimate. The matter of tracing the vestibular nerve in the human brain is just a little difficult, but in a sheep's brain, both by the naked eye and by transverse section thru the trapezium stained by Pal-Weigert process, the nerve can be distinctly traced with the unaided eye to the vestibular nuclei. The reason for this is that in the sheep's brain the

trapezium lies immediately on the surface and can easily be identified. In the human brain, on account of the tremendous development of the pons varolii, the trapezium is buried completely—another plea for the study of brain anatomy by means of material obtained from the lower animals. The reason for a small amount of fibers in the pons varolii of the lower animals is because of the small cerebellar hemispheres, and the pons varolii is the great transverse association tract between these hemispheres.

In the sheep's brain, at each extremity of the trapezium the facial nerve can be seen, as large as a good sized twine string. The auditory nerve is even larger than this and requires no stretch of the imagination to be identified.

Another anatomic structure in the midbrain that might be mentioned is the corpora quadrigemina. In fishes, amphibians and birds, there are two structures in this neighborhood, forming what are often called the optic lobes, but when we reach the lower mammalia, differentiation begins to take place by a transverse groove or sulcus that divides these optic lobes into four. The anterior pair remain very large, and the posterior pair just capable of demonstration in the gross specimen. In the birds and lower animals, the auditory and optical centers lie in these optic lobes, or begemini as they are sometimes called. As soon as the cerebrum becomes fairly well developed, the visual and auditory conscious centers are transferred to the cortex, and the purely mechanical functions, such as orientation of the eye, remain located in the midbrain, the anterior pair being associated with eye movement and the posterior pair with the auditory apparatus.

A new arrangement of the various groups of cells in the third nerve nucleus has been worked out by brain physiologists and pathologists, as follows: in the anterior extremity of that nucleus is a group of cells that send their fibers across the middle line to the internal rectus muscle of the opposite eye, and another direct tract has been found between the sixth nerve nucleus and the third nerve nucleus of the same side. This makes a very intimate corelation for the simultaneous contraction of the external rectus of the one eye and the internal rectus of the other. The drawing I have made of this is diagrammatic, but it makes the synchronous action of the lateral movement of the eye very simple. This drawing diagrammatically shows how the anterior basis bundle of the cord, the Deiters' nucleus, the accessory nucleus and the third, fourth and sixth nuclei are hitched up.

**Oculomotor Disturbances.**

DR. E. V. L. BROWN reviewed the pathology of Lesions of the III, IV, and VI Nuclei and called special attention to the fact that lesions located along the nerve roots and fibers may produce the same effects as those located in the nuclei themselves.

DR. THOMAS FAITH read the paper on etiology and treatment, published in full on page 610.

*Discussion.* DR. JULIUS GRINKER said: More ophthalmologists should have such ready command of the anatomy, pathology and etiology of the ocular nuclei. The borderline between ophthalmology and neurology is very close indeed, and both specialties need closer cooperation. With reference to Dr. Boot's case, he thought that if the patient were hysteric, she could not definitely mark the distance at which she began to see double. According to Dr. Boot's observation, in the beginning the patient could not move either eyeball, beyond the middle line; this condition had improved so that now she began to see double only in the extreme lateral direction. Dr. Boot was very explicit in his statement that there was shock. Everything pointed very strongly in favor of slight nuclear hemorrhage in this case, tho Dr. Von der Heydt's remarks might correctly apply to other cases.

DR. VON DER HEYDT said that Dr. Burkholder had shown that hemorrhage could be at one place in the fourth ventricle, and thus cause a double abducens paralysis. This was very near vital centers. Would it not

be possible to have an irritation of the convergence center, or hysteria? There were three points in favor of it being hysteria. A young girl, posttrauma, who had the ability to move both eyes out completely. A convergence in this instance might be a spasm of the two interni, which latter so commonly act in physiologic coordination, hence might for that reason be under suspicion.

Dr. Thomas Faith thought that sixth nerve paralysis was very possibly, or probably due to hemorrhage. Just as spasm could be present, so also could paralysis if a stimulation or irritation was carried on further, and it would seem where there was such a small area as a center, there was a great possibility of hemorrhage causing bilateral abducens paralysis. He had seen several cases in which no spasm was apparent, in which there was no difficulty in demonstrating a paralysis. He had always felt, when he made a diagnosis of hysteria, that he might not know what he was talking about, and that if he called the right man in consultation he would have found the right condition and it would seldom be called hysteria. On the other hand, if a diagnosis of hysteria was made, it would seem, as Dr. Grinker had said, that there must be something further to bear out that theory. Particularly in Dr. Boot's case, the presence or absence of field changes such as occur in hysteria, might give some satisfaction, as so many cases of hysteria that had no eye manifestations had field changes which were typical of hysteria.

Clarence Loeb, Cor. Sec.

## MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

April, 1924.

### Restoration of a Contracted Socket.

Dr. Ellett exhibited a patient, previously reported to the Society, in which a plastic operation had been done in December 1923 by Wheeler's method for restoration of a contracted socket.

### Kuhnt-Szymanowski Operation.

Dr. Ellett presented a patient upon whom a plastic operation (Kuhnt-Szymanowski) had been done March 29th, 1924 for senile ectropion.

### Needling and Simple Linear Extraction.

Dr. Ellett presented a patient, both of whose eyes had been operated on for zonular cataracts about 2½ years ago. A needling, followed by simple linear extraction, was done in both eyes.

D. H. Anthony, Sec.

## OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM.

### Annual Congress, Glasgow.

1924, May 1, 2, 3.

The Society this year held its three-day Congress at Glasgow University, under the control of the new President, Dr. R. Maitland Ramsay, and it was universally voted a great success.

Sir Donald MacAlister (President of the General Medical Council, London) extended hospitality to the members in a graceful speech of welcome.

### Physiology and Pathology of the Pupil Reactions.

Sir John Parsons opened a discussion on this subject. He said the recent work tended to prove the truth of the theory that the constrictor center was situated near the anterior and inner end of the 3rd nerve nucleus, also that the center for convergence was on the inner aspect, about at its middle, and that the accommodative fibers were situated at the posterior end of the nucleus. The superior colliculus, he said, had developed in man proprioceptive functions, and that fibers connected it with the vestibule. Possibly it had connection with the pupillary reactions. It was considered that the dilator center was near the third nerve nucleus, tho recent research allocated to it a position higher up. The pupil was in a constant state of unstable equilibrium, and the question bristled with difficulties.

### Anatomy of Normal Lens, seen by Slit Lamp.

Mr. T. Harrison Butler read a paper on this subject, illustrated by

numerous lantern slides. He said the lens was examined by the slit lamp chiefly by two methods: with the broad ribbon of light, and with the narrow ribbon, the latter being employed for using the principle of optical section. Examination with the broad ribbon gave further information concerning the various surfaces of the lens as seen from the front, and with regard to the related structures. It was necessary to examine a large number of cases, and by piecing what was seen together, to get a good conception of the whole.

He said it was generally very difficult to separate the infantile nucleus. A great mistake, tho one frequently made, was to imagine that sclerosis was the same as heightened refractive index. In the lens of the infant the difference between the refractive index of the central part and that of the peripheral part was greater than in the adult. The increased hypermetropia sometimes occurring after 50 years of age was due to a disturbance of balance.

**The Trigeminal Nerve as an Integrating Mechanism Between the Nose and Eyes.**

DR. IVY MACKENZIE read a paper on this subject, his object being to discuss the anatomic distribution of the 5th nerve, from the point of view of its functions as an integrating mechanism in the tissues to which it was related. It was the only sensory nerve in the body which was found in every stage of vertebrate evolution. Its importance became more manifest when one considered the Gasserian ganglion. Besides the branches it gave off to the meninges, it supplied, in its first division, important branches to the internal structures of the eye, and it had an important control over the secretions coming from structures inside the cranium. Experiment had shown that sensory nerves were capable of conveying stimuli from the central nervous system to the periphery, as well as in the contrary direction.

A second important point was, that the nucleus of the fifth nerve was the site of stimuli, just as much as the seats of the peripheral distribution. The majority of headaches were due to irritation or intoxication of the trigeminal nucleus. An important feature illustrated in the trigeminal nucleus was the irradiation of stimuli. Sensory nerves produced long systems of collaterals, but in the trigeminal nerve there was said to be independent system joining the various parts of the nucleus to each other. When diseased teeth gave rise to eye disease, he believed the neural energy, dispersed in the cerebral direction, picked out the eye because of the refinement and delicacy of its structures. Its fluids were probably under the control of the fifth nerve. The control of nutrition had a close relation to painful stimuli.

**Physiology and Pathology of Pupil Reactions.**

MR. R. FOSTER MOORE described a series of seven cases of what he regarded as a distinct group, owing to the close way in which they simulated the Argyll Robertson pupil. Syphilis had been suspected in several of them. There was an almost complete inaction to light stimulus, a sluggish contraction on convergence after which it slowly relaxed, it was mostly unilateral, and there was integrity of accommodation. In these cases the knee jerks were present, and even after many years no sign of nervous disease could be detected. He entered into detail concerning the cases. The pupils of all the cases dilated freely with mydriatics, and the author thought the condition congenital. He suggested for the condition the name "Nonluetic Argyll Robertson pupil."

**Central Scotoma in Anterior Uveitis.**

MR. J. GRAY CLEGG read a paper on this subject. He said anterior uveitis or iridocyclitis revealed itself by the following conditions, tho the first was frequently absent: (1) limbal injections, (2) deposits of masses of cells on Descemet's membrane, (3) occasional deposits on the anterior capsule of the crystalline lens, (4) posterior synechiae, (5) vitreous opacities, (6) punctate anterior choroiditis.

In toxic amblyopia the scotoma was central, and began with the loss of color sense for green, then for red, then for blue, and, in an aggravated case, for white also. The central

acuity of vision was lowered. These results were now mostly regarded as due to changes in the retinal elements. Secondary changes took place in the papillomacular band. When the toxic influence could be removed—by abstention from smoking, or excessive drinking, or in diabetic patients the elimination of blood sugar—complete recovery ensued, and vision returned to normal. But in anterior uveitis the disease was caused either by the direct action of a microorganism, or, more frequently, by toxins affecting the uveal tissue.

**Pathology of Keratitis Punctata.**

MR. M. S. MAYOU, discussing this subject, said that the rôle played by the lymphocyte and plasma cells in chronic inflammation was not yet understood. Though these cells were nonphagocytic, they presented barriers to the spread of inflammation, both from the local lesion and after the poison had reached the lymphatic glands. The barrier he thought was due to the breaking down of the cells setting free antibodies (leucocydin). The tendency of lymphocyte and plasma cells to run into nodules was well seen in keratitis punctata and other conditions, and it was probable that this massing together of cells was due to an agglutinin body in the aqueous, and he still regarded agglutination as an important factor in the formation of these deposits. Agglutinin caused clumping of bacteria when held in suspension. Red blood cells were found to be agglutinated by such poisons as ricin; and it was possible that toxic substances might produce an agglutination of comparatively nonameboid cells, such as lymphocyte and plasma cells. Agglutination was also seen in the granules of pigment from the iris, ciliary body, or choroid, which had made their way forward into the anterior chamber. Possibly this might be due to the electrical condition of the particles.

**Early Capsular Discission After Operations for Senile Cataract.**

MR. W. B. INGLIS POLLOCK, in setting out the advantages of this operation, said that for three years he had, whenever possible, carried out his cataract extractions without doing iridectomy, because then the patient was left with a round and mobile pupil. The sphincter pupillae was untouched, and its subsequent activity provided a safeguard against the onset of glaucoma. Moreover, it was almost impossible for strands of the capsule of the lens, or portions of the vitreous body, to be left entangled in the lips of the wound. But if the lens was not fully mature, the parts remaining attached to the capsule became swollen and opaque, and passed into the pupillary area on the second or third day after operation. Usually they dissolved, and by the 15th day the pupil was much clearer.

He described his operative procedure in detail. He said he had found that most of the cases with iritis had septic teeth, and when the latter were removed, the iritis subsided. When division of the capsule was undertaken late, it was calcareous, and great tension was required in dividing it. By following the procedure he described, he said, the patient was spared a secondary cataract operation and he claimed that the operation gave the advantages of intracapsular operations without their dangers.

**Operation for Glaucoma when Iridectomy Fails.**

DR. G. F. ALEXANDER offered a suggestion for dealing with cases in which iridectomy failed, with the object of facilitating escape of aqueous by freely opening the section subcapsularly, so that it might be into Tenon's lymph space. He considered that if, after a time, fibrous tissue formation in the section were to render the percolation insufficient, a repetition of the operation would permanently remove this tendency. The section for the iridectomy should be behind the cornea, and might with advantage be made with a narrow Graefe knife, and accompanied by the making of a conjunctival flap. As, after this operation, the escape of the aqueous was linear, the covering tended to be flat, and as it consisted of both conjunctiva and the capsule of Tenon, the risk of infection was minimal.

**Some Ocular Signs in Subarachnoid Hemorrhage.**

MR. LESLIE PATON, in the course of an exhaustive thesis, dealt with the ocular complications met with when an aneurysm ruptured in one of the arteries of the brain and produced a subarachnoid hemorrhage. Incidentally, he referred to traumatic hemorrhages, especially those resulting from fractures of the base of the skull. The effects of traumatic hemorrhages, he said, differed in many ways from those produced by spontaneous or nontraumatic hemorrhage. Some of the eye symptoms might be the result of the fracture, not of the subsequent hemorrhage. The source of the subdural sheath hemorrhage in traumatic cases might be rupture of the small dural vessels in the optic foramen.

Subdural hemorrhages might occur in various vascular and blood diseases, such as scurvy, hemophilia, various anemias, alcoholism, etc., and retinal changes might be found in any of these.

The main cause of spontaneous subarachnoid hemorrhage was rupture of an aneurysm in one of the basal arteries. The aneurysm might be either congenital or acquired, the former being the more frequent, "congenital" meaning not necessarily that the aneurysm was present at birth, but that there was a congenital weakness of vessel walls which made the later development of aneurysm easy. The most frequent site for these aneurysms was the anterior half of the circle of Willis. Probably very little effect was produced by an unruptured basal aneurysm. Oculomotor disturbances were by far the most frequent results of aneurysmal rupture; they occurred in about 70 per cent of all cases, and the third nerve was the most frequently affected.

The occurrence of retinal hemorrhages apart from papilledema might be due to local disease of the arteries, similar to the lesion responsible for the intracranial bleeding, or these hemorrhages might result from such blood conditions as scurvy or anemia. Some of them, he thought, were due to leakage of blood thru the subpial lymph spaces around the lamina cribrosa, and thru the perivascular lymph spaces round the central vessels.

**Iridectomy in Congenital Cataract.**

MR. J. ROWAN (Glasgow), in a paper on this subject, said he had come to the conclusion that if there was a clear bit of lens, or if a clear bit of lens could be brought into use after an iridectomy, then iridectomy was preferable to needling. If, however, the lens was quite opaque, the question of iridectomy was not raised. The position of choice for the iridectomy was down and in. He had never seen these cataracts increase in after years. A great advantage was that the patient could go about his ordinary work without spectacles, whereas if needling were done, the patient had to wear glasses for his work, and also for reading. Before deciding on the operation for a particular case he tested the patient with undilated pupils, and if the distant vision was better with dilated than with contracted pupils and if part of the lens was clear, he always did an iridectomy, as small a one as possible.

**Advantages of Strong Atropin in Cataract Removal.**

DR. G. F. ALEXANDER said that in the absence of synechiae, the extent of the dilatation given to the pupil varied directly with the strength of the solution; but it seemed to vary inversely with the degree to which the patient was the subject of arteriosclerosis, rather than with the actual age. Sometimes the usual strength of atropin failed in its purpose, and he had found that by placing a small drop of a 5 per cent solution in the outer limit of the lower fornix an hour before the operation, the pupil was dilated to its maximum extent at the time of operation, prevented contraction on the escape of aqueous, and the dilatation was maintained for several days after the operation, in addition to there being immunity from toxemia. He related a number of other advantages from the practice.

**Relapsing Traumatic Keratitis.**

MR. SPENCE MEIGHAN read a paper entitled "Two cases of relapsing traumatic keratitis". They were the only

two cases of the kind he had met with in seven years' experience.

The first patient attended because he felt something enter his eye while in the factory. No foreign body could be seen, but the ambulance attendant at the works scraped the cornea. Three days later a corneal ulcer was present. In a fortnight the eye was watering and was irritable, and there was circumcorneal injection. Tension, judged by the finger, appeared normal. A week later he had developed a vesicular condition over the lower half of the cornea. The treatment applied consisted of boric acid solution, atropin drops, and yellow oxid ointment. Tension increased, and he was admitted to the infirmary, where paracentesis, and, later, iridectomy, were performed. After the latter there was much hemorrhage into the anterior chamber. The general condition improved after this, tho the vesicles persisted. The epithelium was easily removed by cotton wool on a probe, and the cornea was clear beneath. A conjunctival flap was made to cover the whole denuded area of the cornea, yet the eye remained irritable, and pain now became a prominent feature. A spot of pigment appeared, and the condition became worse. Excision was carried out.

Microscopic examination, carried out by Dr. Marshall, showed a patchy interstitial infiltration of the cornea; the epithelium was detached from the central part. There was considerable infiltration of the subconjunctival tissues at the limbus; there was a well marked keratitis punctata on the lower half of the cornea. Also there was a well-marked uveitis, and the iris and anterior part of the ciliary body were infiltrated with plasma cells.

The second patient had been struck by a splinter of glass following the breaking of a beer bottle, resulting in an extensive wound of the cornea. The attempt to remove the spicule of glass was unsuccessful, as it was really a split in the substantia propria of the cornea. The cornea healed without complication. Fifteen months later he was seen again, the history being that the eye had remained well until six months before, since when he had begun to lose the sight in the eye, and the eye was now watery and tender. In spite of continued treatment, the eye still failed to recover at the time of reporting.

### Eye Symptoms in Early Diagnosis of Disseminated Sclerosis.

MR. BROWNLOW RIDDELL in this communication gave some interesting notes of cases of disseminated sclerosis which had been seen by him when no organic change was suspected, in order to draw attention to the importance of eye symptoms in an early recognition of the disease.

One case had mild retrobulbar neuritis, the nature of which was not appreciated until, much later, the patient had the same affection in the other eye, and in due course the diagnosis became obvious. Another subject of the disease had first only diplopia of three weeks' duration. Similar cases which could not be otherwise explained should be kept under careful observation, the possibility of disseminated sclerosis developing later being kept constantly in mind. Tho the immediate prognosis of retrobulbar neuritis was good, in a certain proportion a second attack developed at some future date, and then some organic disease of the central nervous system became manifest. He related a number of cases bearing on his thesis. These patients were not old, their affection ran a chronic course, and they were quite able to contract various diseases which ended fatally, hence the condition, often, was not diagnosed. He urged thoro antisyphilitic treatment from the earliest stage at which the particular patient was seen.

### Slit Lamp Features of Tumor at Limbus.

MR. BASIL GRAVES said that he desired to put forward one small example of a line of work which he was pursuing at the Royal Westminster Ophthalmic Hospital, in conjunction with Dr. Alfred Piney, Director of the Institute of Pathology of Charing Cross Hospital, which aimed to correlate clinical slit lamp findings and subsequent histologic findings. There were many points in this new slit lamp work to which, as far as he was aware, atten-

tion had not yet been drawn. He proposed to mention one or two of them which were presented by this case. He would use terms which he had suggested at the Congress a year ago, and which were described and illustrated in the Transactions of the Society for 1923.

If the normal accurately focussed narrow slit bundle was observed traversing the cornea, an intensification could be seen at its epithelial line of entry which is not wholly due to properties peculiar to the epithelium. It is not seen too easily in the case of the cornea, because the substance of the cornea beneath is relucent. But a line of surface intensification is easily demonstrated in a piece of plain glass whose substance is not relucent, and it is due to modification of the rays by the infinitesimally small irregularities in what, by ordinary standards, is generally adjudged to be a smooth demarcating surface between two light transmitting media of different refractive indices. Mr. Graves gave examples of the clinical importance of recognizing this line, which he called the epithelial impact-line, amongst them the fact that its elevation at the limbus, in the case, afforded one of the chief means of detecting and mapping out this obscure 3 mm. tumor.

The next point dealt with and rendered clear by illustrations on the epidiascope, referred to a change which might always be seen in the character of the intracorneal portion of the normal slit beam. As the relation between the incident axis of illumination and the axis of observation came to approach that necessary for seeing the corneal endothelium along the axis of its mirror like or specular reflection, there was seen a vertically striated almost scintillating faint golden tinsel color in that part of the beam situated in general in front of the specularly reflecting endothelial area. By means of diagrams Mr. Graves explained this manifestation and various features connected with it as being due to a summation of the effect of multiple specular reflections, occurring from the irregular semilaminated or stratified structural principle on which the cornea is built.

He had clinically seen this modified at the limbus by such conditions as intralamellar edema and hematogenous cellular infiltration, and that altho his clinical experience of the slit lamp examination of the type of limbus tumor now shown was as yet small, he could say only that in this particular case the golden specular glint was undisturbed in the intracorneal beam beneath it. Mr. Graves then quoted the histology report of Dr. Piney which showed that the deep activities of the epithelium, in this case, were limited by a basement membrane which was intact.

The instances in which, from a practical point of view, the recognition of this specular phenomenon is of aid to diagnosis are very few as regards the cornea. But a similar reasoning may be applied to the study of the lens, in the case of which the recognition of a connection between, on the one hand, specularly reflecting manifestation along the course of the sectional beam and, on the other hand, a fine multiple lamination of structure is of the greatest importance, in the understanding and teaching of the subject of the optical section in the lens. He had justification for supposing that, from the years even of adolescence, changes may occur in the character of the optical section of the lens of some individuals, whose interpretation could be understood only on the basis of these views which he suggested.

A third point mentioned was the clinical recognition—by a proper interpretation of the behavior of light, from a very intense beam of very small diameter, scattered by proximal illumination in their neighborhood—of tiny vacuolar, crypt like spaces, in the epithelial processes which grew down into the comparatively nontransparent tissue composing this tiny tumor.

Mr. Graves showed the clinical slit lamp drawings of the little tumor and pointed out how the clinical picture, as he had painted it, was not really a scientific representation of the true slit-lamp appearances. He said that prescribed conditions of illumination dif-

fering from that drawn were necessary clinically, to detect certain elements in the tumor and to elicit other features, such as the precise depth from the surface of some small pigment spots in the tumor; and that the effects which he had drawn were really an artificial combination in diagram, of multiple effects obtained by different methods of illumination and observation, including the use of a very intense beam of very small diameter.

Mr. Graves gave a practical demonstration on patients of some of the more difficult features of clinical slit lamp technic, including some of those he had spoken of. For this he used a prism binocular demonstrating device which he had applied to the corneal microscope; by means of this it is possible for a demonstrator practised in the use of the apparatus to show a novice who has never yet used the apparatus all the clinical slit lamp features which are usually difficult for a beginner to pick up. Whereas the beginner who has previously seen, by glancing thru the demonstration tube, the actual clinical condition he has to look for can quickly learn, when controlling the apparatus himself, so to manipulate it that he will readily produce the desired effect, especially as the demonstrator may in turn control the learner's own manipulation of the apparatus, by changing over and taking his view thru the demonstration tube. The device particularly facilitates the rapid teaching of the different methods of illumination and observation, such as those depending on observation along the axis of specular reflections.

H. DICKINSON.

## REPORT OF THE COMMITTEE OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY ON UNDERGRADUATE MEDICAL STUDIES.

This is the second and final report of a Committee, appointed to consider a suggestion, made by a university head over two years ago; that ophthalmology, as a distinct branch, might be eliminated from the undergraduate curriculum. A comprehensive questionnaire sent to the leading medical schools in America furnished the basis of the first report. The replies received have been considered and supplemented, and recommendations are now made. These deal with the hours of instruction to be allotted, their division between didactic, clinical and other forms of teaching, with an outline of the topics to be brought before the undergraduate medical student. The report was adopted by the Society June 17th, 1924, and its publication authorized.

This final report is based on the provisional report of last year with its supplementary statements; on a fuller consideration of the replies received to the Committee's first questionnaire; and on a study of the answers to a circular letter sent out this year, with copies of the provisional report, to those who replied to our first communication.

Your committee has heard from forty-two directors of outstanding ophthalmic departments in America, and from a perusal of their replies can state that there is absolute unanimity of opinion on the part of teachers in regard to the desirability of continuing ophthalmology as a subject in the undergraduate medical curriculum. The supplementary statements appended to last year's provisional report show that graduates also are largely of the same mind; and as the views expressed by the graduates regarding what should be done to better the courses in ophthalmology are in accord with the opinions of our correspondents, there is little question that, had the students been made to cover the field in the way that is now suggested, the replies from the graduates would have been as fully in favor of maintenance as were the replies of the teachers.

The committee feels that the suggestion that ophthalmology in its entirety should be eliminated from the undergraduate course is unsound; for the reason that a certain number of ophthalmic problems take rank among the most important confronting the general practitioner, and that it is illogical to neglect these in favor of minor problems in the major subjects. Moreover, they are of the mind that it is premature to suggest the elimination of ophthalmic work until everything

possible has been done with the undergraduate curriculum as a whole to prevent waste of time resulting from inefficient methods of teaching and the inclusion of obsolete and irrelevant matter.

In regard to what part of ophthalmology should be taught, there is likewise unanimity of view. The consensus of opinion is, that the undergraduate course in ophthalmology should be designed solely to meet the requirements of the general practitioner. Working from this point of view the Committee has drawn up the following list of the disorders likely to be met with in general practice, that is, the disorders that must form the basis of the undergraduate work.

1. *Simple disorders of the eyes:* Marginal blepharitis, aberrant lashes, styes, meibomian cysts, chronic catarrhal conjunctivitis, foreign bodies in the conjunctival sac or on the surface of the cornea.

2. *Serious disorders of the eyes:* Dacryocystitis, burns, wounds and injuries (sympathetic ophthalmia, panophthalmitis), acute generalized conjunctivitis (ophthalmia neonatorum), trachoma, pterygium, phlyctenular keratoconjunctivitis, ulcers of the cornea (simple, hypopyon, exposure, neuropathic), interstitial keratitis, iritis (iridocyclitis), glaucoma, cataract, axial neuritis, myopia, convergent strabismus, tumors in (detachment of retina), on, and about (orbital) the eye, orbital cellulitis.

3. *Ocular findings in systemic diseases and affections of the nervous system:* Ocular paralyses, pathologic changes in the field of vision, optic neuritis (choked disc), optic atrophy, chorioretinitis, albuminuric retinitis, retinal hemorrhages, exophthalmos (Graves' disease, sinus thrombosis).

4. *The symptom complex of socalled eyestrain.*

But making up as they do in their entirety a large part of the subject of ophthalmology, it is clear that it is impossible in the undergraduate course to impart full information in regard to these conditions. In the case of the simple disorders it is felt that the entire treatment of these cases, including operative measures, might be left with safety in the hands of a general practitioner. With the serious disorders of the eye, however, the second division —the general opinion, strongly expressed, is that the most we should strive to accomplish is to teach our students to recognize these diseases as menacing disorders that call for immediate and fully effective treatment, and to instruct them in all that a general practitioner should be expected to know in the way of temporary measures. Emphasis, therefore, is to be laid on diagnosis, on certain cardinal points in etiology and therapeutics, on general surgical principles in eye operations, and on the essentials of ophthalmic nursing. Training in the last two implies brief attendance at eye operations and short visits in the ophthalmic wards; but with very rare exceptions teachers are opposed to operative work for undergraduates, apart from the opening of styes and meibomian cysts as previously mentioned.

Under the third division—ocular findings in systemic diseases and affections of the nervous system—one is dealing with the subject of medical ophthalmology; and here there is a considerable overlapping with other departments, with medicine, surgery, and neurology. If this work falls to the lot of ophthalmology, as it properly should with its fuller knowledge and more refined methods of diagnosis, then every hour of the time allotted to the subject under recent decisions will be fully occupied.

The really debatable point is how far one should go with ophthalmoscopy. A very few teachers feel that it is futile to attempt anything in this direction, but the great majority of the teachers, and a strong body of graduates, demand ophthalmoscopic training. The wishes of the majority would be met if the students could be taught to recognize the derangements specified in class 3, and it is thought that if the technic is so far mastered, further development is assured thru individual effort. At the same time it is strongly urged that the undergraduate should be made to carry away with him the conviction that his undergraduate training with

the ophthalmoscope is necessarily incomplete, and that he should seek confirmation of his findings before passing final judgment.

The wide spread occurrence of so-called eyestrain, the discomfort and disability it entails, and the frequency with which its attendant symptoms simulate those of organic disease, demand that the undergraduate should be made familiar with the bizarre picture of, and the reasons for, asthenopia.

The diagnosis of the disorders in the foregoing list calls for a training in the methods and tests entering into the routine examination of the eye. The difficulties here lie not so much with the diseases of the eye itself as with the problems in the field of medical ophthalmology. It is obviously impossible to impart a comprehensive knowledge of this field, especially as regards perimetry, the muscular anomalies, and refraction; but simple tests are available and easily taught, and these, systematically employed, can yield satisfying results as every teacher knows. The Committee feels that with efficient teaching the work as outlined below would meet the requirements of the undergraduate course.

*Outline for the Methodical Examination of the Eye.*

The place of the eye in the general examination of the body; the importance of routine, and the sequence to be followed, in ocular examinations:

Correct method of separating the lids; eversion of the lids (puncta); finger pressure test for retained secretion in the lacrimal sac; oblique illumination; magnification with the loupe; window reflection and fluorescein tests for corneal inequalities, abrasions, and ulcers; pupillary reflexes; the ophthalmoscope—for axial illumination, direct and indirect methods; recording of central vision; eye-to-eye or "confrontation" methods of taking the field of vision; simple tests for motor anomalies; simple test for central scotoma; finger test for intraocular tension.

The course as outlined presupposes a training in the primary years in optics, as well as in the anatomy (histology) and the physiology of the eye; but the impression received by the Committee is, that with notable exceptions this ground work is not so thoroly covered as it should be. Reviews and talks on the applied anatomy and physiology of the eye are indicated in the ophthalmic course, but to be obliged to cover practically the whole work of those subjects constitutes a serious handicap. On the other hand it was clear that many of the teachers were uninformed regarding what was being done in the early years of the medical course. The teachers in the primary departments would undoubtedly cooperate if the necessities of the work were pointed out, and it is suggested that conferences alone would yield satisfying results.

As regards the time to be devoted to ophthalmology in the undergraduate course, a small number think that fifty hours would suffice—no one falls below this minimum; while an equally small number deem eighty, or even one hundred, hours none too much. The strong consensus of opinion is that sixty hours is adequate and since this number has been fixed by the American Association of Medical Colleges as the proper allotment to ophthalmology from a course of 4000 hours (½ per cent), it is not likely in any case that for the present any change could be made in this figure.

Touching the distribution of the alloted hours there is not the same unanimity of opinion among teachers. Last year the Committee put forward as a suggestion the following division:

1. *Didactic instructions:* Lectures variously illustrated and covering the place of ophthalmology in medicine, the relation of the eye to other organs, and general principles, 4-8 hours.

2. *Clinical instruction:* 52-56 hours, divided as follows: (a) Routine methods of examination, 4 hours; (b) Ophthalmoscopic findings in systemic disorders and diseases of the nervous system, 15 hours; (c) External diseases of the eye, 37 hours.

The main criticism of this division is directed against the number of didactic lectures.* A few of the teach-

*It is taken for granted that the oldfashioned didactic talk is a thing of the past. The term here is meant to cover lecture-demonstrations, and everything in the way of formal reviews, quizzes, and written or oral class examinations.

ers are entirely against didactic work in any form, while another small group feel that taking the subject as a whole more time should be devoted to didactic work than to clinical instruction. Quite a number would also like to see a few more hours given to ophthalmoscopy of the normal fundus in the routine examination. The wishes of the majority, therefore, would be met by a moderate increase in the number of hours for didactic instruction and drill in the routine examination of the eye at the expense of the clinical and advanced ophthalmoscopic work. The Committee, therefore, feels that the following simple division more nearly expresses the views of the correspondents as a whole.

(1) *Didactic instruction:* Lecture—demonstrations, reviews, quizzes and class examinations covering the theoretic requirements of the subject, 8-12 hours.

(2) *Clinical instruction:* Including routine methods of examination, and with a minimum of fifteen hours devoted to ophthalmoscopy, 48-52 hours.

In discussing this phase of the subject, the aims of the school and the kind of hospital with which the teacher is connected undoubtedly influence the views expressed. In general hospitals the tendency is to stress medical ophthalmology, while in ophthalmic institutions, where there is an abundance of material, the clinical side of the subject is emphasized. It is really not possible to make an allotment of hours that would be generally satisfying. The Committee's division is meant to serve as a suggestion only and not as a standard to be rigidly followed. It is, however, an expression of their opinion in regard to the relative amount of time that should be devoted to the two phases of teaching.

With regard to a general method of instruction there is not the same concensus of opinion. The majority certainly favor clinical teaching in small groups, while a strong minority prefer to present their cases before the class as a whole. There is something to be said in favor of both practices. Small groups are conducive to more intimate instruction, but they restrict the number of cases for the individual student, and greatly increase pedagogic work. Larger groups mean opportunity to see a larger number of cases and less strain on the teachers. In small centers, or in centers with limited clinical material, it is almost necessary to teach in large groups if the students are to see types of all the diseases with which it is thought they ought to be familiar. The question is in great measure a matter of expediency, and perhaps a compromise is indicated. Instruction in small groups for intimate training might be followed by, or carried on concomitantly with, instruction in large groups to ensure broader experience.

Undoubtedly the practice of the various centers in this connection would be more uniform, if the available material were greater. As pointed out last year, if one excludes three large clinics, the average number of new patients for thirty-five centers was only four a day, that is twelve hundred a year. This finding means that there is a scarcity of patients for demonstration purposes. It is suggested that something might be done to remedy this deficiency by the fusion of small autonomous clinics, or by an increase in the number of clinics held.

Opinions on the value of the other means of instruction—quizzes, written and oral class examinations, preparation work, case reporting, pathologic studies, etc., vary, as one would expect, with the individual. Some men teach better in one way; others in another. The Committee thinks it would be unwise to lay down any hard and fast rules in this field; but they have been greatly interested in reading the views of their correspondents, and they feel that in the discussion of this report an interchange of opinion on methods of instruction would be both interesting and profitable to the members of the Society.

In regard to what one might call the material aspect of this subject, findings of importance are that with few exceptions the ophthalmic departments of our colleges do not possess the facilities, and do not receive the monetary support they require to perform their

work in a satisfying manner. As we pointed out last year, of thirty schools reporting, fourteen apparently receive no assistance whatever, while the average budget for the remaining sixteen is only $1,450 per annum.

This Committee was originally appointed to investigate the status of undergraduate teaching of ophthalmology in America and report to this Society with their recommendations.

After a survey of the whole field, the Committee would say that, while undergraduate instruction in ophthalmology is being efficiently carried on in many of the colleges, the work in a large number of centers is of an indifferent character, and that generally speaking there is room for improvement.

Looking to the betterment of undergraduate teaching in ophthalmology in America, the Committee would make the following suggestions:

(1) That undergraduate courses in ophthalmology should be designed to meet solely the needs of the well-trained general practitioner along the lines laid down in this report.

(2) That as fully as possible the clinical side of instruction should be emphasized rather than the didactic side.

(3) That teaching should be done in the smallest practicable groups.

(4) That a general effort should be made in the ways indicated to increase the clinical material for ophthalmic teaching purposes.

(5) That complete coordination of the work of the primary subjects and of ophthalmology should be secured by early conferences, and

(6) That, when and if adopted by you, copies of this report should be sent to the heads of the medical schools of America, as representing the views of the American Ophthalmological Society on undergraduate teaching in ophthalmology, and on the need for increased monetary assistance in carrying on the pedagogic work of our specialty.

W. Gordon M. Byers, Chairman.
E. V. L. Brown,
George S. Derby,
William C. Finnoff,
Arnold Knapp.

**Schacherl, M. Endolumbar Salvarsan Treatment in Tabetic Optic Atrophy.** Deutsche Zeit. f. Nervenhlk., Bd. 77, October, 1922.

The author takes the same stand as previously, that endolumbar therapy should only be applied where other therapeutic measures fail.

It will not prevent blindness in advanced cases with a high positive spinal fluid finding; but should be considered in cases with practical useful vision, altho in very active syphilis, an increased diminution of vision and field with preservation of useful vision is a possibility. The best prognosis of course applies to early cases with not too active syphilis.

Schacherl treated since 1918, 64 cases of tabetic optic nerve atrophy, 31 of which interrupted treatment. 2 cases were not accepted because hopeless, 22 cases are still under treatment; 4 cases have stopped showing favorable results, but on account of the short time are not considered.

The treatment is combined with intravenous salvarsan therapy. The endolumbar injections are made every 2 weeks. The dose increased from ¼th to 1 mg. (per dose) salvarsan. No complications were seen. The treatment is continued until all reactions in the blood and the spinal fluid have become normal; and then, for security, 2 or 3 endolumbar injections follow in normal time intervals. Should the process flame up again, which did not occur, the cure should be repeated. After one year the spinal fluid reaction can be tested each half year, and after 2 years each year once. With every endolumbar injection an intravenous injection of staphylococcus vaccin is given.

Five favorable case histories follow. The ophthalmoscopic data came from Prof. Dimmer's clinic. The end result is relatively favorable even if the treatment has a long duration. It seems as if the treatment long before its end retards the course of the disease. Increased impairment in the beginning of the treatment should not discourage. Only a recovery of the function of anatomically spared fibers can be expected.

E. E. B.

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## SODIUM SALICYLAT BY INTRAVENOUS INJECTION

Sodium salicylat has been used for so called rheumatic conditions of the eye ever since the drug was first proposed for use in acute rheumatism, forty-eight years ago. It has been more commonly and freely used for all acute uveal inflammations since Harold Gifford, in 1899, pointed out its value in large doses, for treatment of sympathetic uveitis. It has also been rather widely used in such conditions as scleritis and acute retrobulbar neuritis, with apparent benefit. Gifford used and recommended it in large doses; to give as much as one grain a day, or even more, for each pound of body weight. But if notable improvement does not occur within a few days, such doses should be discontinued.

The extremely rapid and striking effects of the salicylat, in some cases of rheumatism, when administered intravenously, were pointed out by Mendel twenty years ago, with a method of preparing solutions for such use. Since then, intravenous medication has become common, especially the administration of arsenical preparations for syphilis; and ampoules of solution of sodium salicylat have been supplied for administering it by this method. It would be strange if no one had given it in this way for relief of the intense pain and to check the dangerous course of acute iritis; but we cannot at this time find any reference to it in ophthalmic literature. Certainly it has not come to be a generally recognized resource for the control of any form of ocular disease.

It may be a method to be used in a comparatively few cases, but it is worth knowng about, and having in mind when one of these cases is encountered. Dr. Black has done a real service in calling attention to it, first at a meeting of the Colorado Ophthalmological Society, and later in his paper presented before the Ophthalmic Section, at the Chicago meeting of the American Medical Association. In the latter communication he has given a full description of the technic.

The cases in which it seems most likely to give striking relief, are those cases of acute iritis attended with atrocious pain, which runs on for days in spite of atropin and hot stupes and which is but slightly mitigated by morphin. In a few of these, the effect has been relief in one or a very few hours. And when one of these cases gets re-

lief sufficient to permit a good night's sleep, it is generally well started on the way to recovery. In some cases of scleritis that were running a very chronic course, very marked benefit was apparent in two or three days.

Not all cases of uveitis or scleritis are influenced in this striking manner. It will add to the usefulness of the treatment if the particular classes of cases, to which it is most applicable, can be exactly determined. It must also be remembered, as Dr. Black points out, that it does not do away with the necessity for recognizing and removing the cause of the uveitis or scleritis in the particular case, neither does it render unnecessary the efficient local treatment, especially of iritis. A single prescription for all cases that are called by a certain name is the objective of the ignorant laymen, the stock in trade of the quack, the resource of the unreading, lazy practitioner. Scientific medicine, recognizing infinite variations in the characters of disease, seeks correspondingly wide resources and discriminating application.

E. J.

## STEREOSCOPIC PICTURES IN BOOKS.

The chief value of radiograms is to show the relations of various structures within the body to each other, or the locations of tumors, accumulations or foreign bodies. Stereoscopic views are far more valuable for this than the single flat picture. For other purposes, too, the stereoscopic impression is more vivid and more informing. Such pictures are sometimes used to illustrate magazines and books; but not nearly so much as they might be. Many people do not know how to look at them in a book, and those who publish such books often show that they do not understand the limitations that must be placed on these pictures so printed.

Some persons think, that to get the stereoscopic impression from stereoscopic pictures, one must place them in one of the forms of instrument made for the purpose and called a stereoscope. They wonder why they should be printed on a page where they have no more value than the single ordinary picture, unless the leaf is cut out and trimmed to fit in the stereoscope. But if the component pictures are of proper size they can be looked at, and the proper effect obtained as well from the page of a book, as from the card placed in the holder of a stereoscope.

The conditions needed to bring out the depth in the combined picture are: the seeing of one of the separate pictures with each eye, with slight convergence of the visual axes, accompanied by a proper amount of accommodation.

Taking the pictures on pages 578 and 579 for illustration. The corresponding points of these pictures are about 55 mm. apart, this is a little less than the distance between the visual axes of most adults. In order to receive the image of the right picture on the right eye and the image of the left picture on the left eye, in corresponding positions the visual axes must be slightly converged. To get the most perfect stereoscopic effect this convergence must be accompanied by a proportioned amount of accommodation.

The Holmes hand sterescope, most generally in use, carries before each eye a convex lens, which reduces the accommodation required to its appropriate amount, decentered or combined with a prism base out, that compels the eye to converge when looking at the picture. The proper relation of convergence and accommodation is secured by sliding the picture toward or from the eyes, to the point where the two pictures fuse into one most completely and easily. Each eye is prevented from seeing more than the picture that belongs to it, by the opaque partition placed in the median plane of the instrument.

But the same conditions can be met on the page of a book, if the two pictures are made small enough; so that their corresponding points will not be more than 50 or 60 mm. apart. At first it may be necessary to hold a card in the median plane of the head, so that

the right eye will see only the right picture and the left eye the left picture. Or it may be necessary to use convex spectacles before the eye, to get the relaxation of the accommodation that belongs with slight convergence of the visual axes. Such lenses can be placed in the ordinary trial frame and may be decentered outward to permit more convergence with the desired fusion.

But for many the accessories will only be needed temporarily. With practice one may learn to relax convergence until each eye fixes its appropriate picture and the impression in relief with a flat picture on either side is secured. The central picture in relief is the stereoscopic picture, upon which attention is to be fixed. The advantage of the card in the median plane is that it cuts out the other two pictures. The presbyope who looks thru his reading lenses has an advantage in this way of viewing stereoscopic pictures.

When a stereoscope is used the advantage is that larger pictures can be employed, the sphero-prisms, base out, permitting convergence, thru their displacement inward of the two pictures. But the ability to see stereoscopically the pictures printed in a book is worth cultivating and using; for such pictures add materially to the sense of reality in most illustrations based on photographs.

## NATIONAL AND INTERNATIONAL.

This year the Ophthalmological Society of the United Kingdom broke quite away from its custom of meeting in or near London; and held its annual Congress at Glasgow, the city of its President for the year. Again American ophthalmologists were represented by Prof. de Schweinitz who, at the annual banquet, offered the cooperation and support of American ophthalmologists to the convention of English speaking ophthalmologic societies in London in July, 1925. A limited report of the scientific proceedings of the Society will be found elsewhere in this issue.

The pledge of cooperation in the London convention has already been taken up by two of our national organizations. At the Chicago meeting the Section on Ophthalmology authorized its officers and executive committee to act for the Section in all matters pertaining to the invitation, representation, announcement, etc., regarding the Congress. At the meeting of the American Ophthalmological Society at Hot Springs, Va., the Society authorized its Council to act for it in the same way, in regard to the London meeting. Those who attended the Denver two weeks' Graduate Course last month had the opportunity to hear from Dr. de Schweinitz a more definite account of the plans and prospects of this important convention. Probably at the meeting of the American Academy of Ophthalmology and Oto-Laryngology in Montreal in September, a direct representative of British ophthalmologists will be present to extend the invitation in person. The visits of Collins, Elliot, Smith, Mackay, Rowan, Clegg, Lister and Spicer to this country of late years, as well as those of Parsons and Kirkpatrick this year, should bear abundant fruit in London in 1925.

## BOOK NOTICES.

**Introduction to the Theory of Spectacles. Otto Henker,** D. Sc., M.D., Director of the Spectacle and Opto-Medical Departments of the Carl Zeiss Works, Jena. Translated by R. Kanthack, London. Cloth, 8vo., 344 pages, 340 illustrations. Jena School of Optics, 1924.

The precision and exact attention to minute detail, closely associated with the works of Zeiss in Jena, have been carried into this book on ophthalmic optics. The firm of Carl Zeiss having applied to the production of spectacles and magnifiers, the same scientific attention to detail, that had heretofore been thought worth while only for microscopes and telescopes, found no one to appreciate the exactness and clearness of the images such spectacles can give.

Even ophthalmologists, who had given much time to the study of "physiologic optics", did not see the prac-

tical importance to the patient of taking into account the exact position and form of the refracting surfaces of the strong lenses required for aphakia or for high myopia. Before there could be much demand for such exactly planned optical corrections there had to be a campaign of education. From this need may well have developed the Jena School of Optics and this book.

The theory of spectacles to which the reader is here introduced is the most developed and elaborated theory of them that has yet been placed before ophthalmologists as a branch of applied science. But the "introduction" begins with the most general and elementary facts. The first portion, which is called an introduction (40 pages), is a presentation of elementary ophthalmic optics that is not excelled in any textbook now before our profession. This presentation is made chiefly by geometric figures. So far as possible the algebraic formulas are avoided or given a secondary position.

The next section of the book is headed "The Normal Sighted Eye," giving implied emphasis to the fact that emmetropia is the ideal or model, toward which the evolution of the eye is directed. What it takes up in its twenty pages is indicated by its subheadings: Anatomic and Optical Constitution of the Eye. Path of the Rays within the Eye. The Pencil Restricting Elements of the Eye. Sharpness of Vision of the Eye. Image Forming Defects of the Eye. Accommodation. The Movable Eye.

Then comes the presentation of the elaborated theory of spectacles under these three headings: "The Defectively Sighted (Ametropic) Axially Symetric Eye and the Spectacle Lens," 74 pages. "The Astigmatic Eye and Correcting Lenses," 56 pages. "Seeing with Two Eyes," 35 pages. "Protective Spectacles," 5 pages; and a five page index follows. It is in the parts of the book dealing with "The Defectively Sighted," ametropic, nonastigmatic and astigmatic eye and spectacles, that the statements of optical truths are made to bear directly on the correction of the optical defects of human eyes, by what might be called superspectacles.

In its rudimentary form the theory of lenses starts with the assumption of an infinitely thin lens, with rays falling perpendicularly on the refracting surfaces. When a lens becomes something more than a theoretic abstraction, these assumptions cease to be true. The greater the strength of the lens, the farther they depart from the truth, the more defective are the images formed by its assistance, and the greater the need to base the forms of lenses upon a more elaborated theory. See paper beginning p. 597.

Taking into account the thickness of the lens, it becomes necessary to measure its focal length, or refractive power, from some particular point of its thickness: hence "vertex refraction," which measures from the surface of the spectacle that is turned toward the eye. To deal with oblique and peripherally placed pencils and to reduce to a minimum the distortion and aberration caused by spheric surfaces, we need the calculation of the curves of both surfaces: and the introduction of the "aspheric" surface required by Gullstrand, calculated by von Rohr, and worked out at Jena. Since the latter must be made to meet the needs of particular conditions and individual eyes, the socalled "Katral" lenses that result must always remain relatively expensive.

To master the advanced theory of spectacles, even to the extent of appreciating the practical application of the benefits they are capable of giving to various classes of defective eyes, requires careful study. It will require, as do mathematics in general, more time and effort on the part of some than of others. But Henker has shown that the facts can be put in such a way as to be quite attainable to any well educated ophthalmologist. Perhaps this is the great service that this book is to render. Others writing or teaching about spectacle lenses can here learn how to explain the facts most clearly to medical men, who have not been working with the formulas and equations of algebra. In this connection it should be mentioned that the work of the translator, R. Kanthack has been admirably done, so

that it is hardly possible that any excellence of the original has been lost in the transfer to English.

The illustrations are chiefly diagrams, well lettered, and each with its brief appropriate legend. The full explanation of the figures constitutes a large part of the text. A few reproductions of photographs illustrate apparatus and methods of using it. There is one plate illustrating the photographs of test letters, taken in the principal axis and with varying degrees of obliquity, thru biconvex spherical, spherocylindrical, katral and spherotoric or "punktal" lenses. These illustrate the relative equality of the different forms when looked thru in the direction of the principal axis; and the great superiority of the "katral" and "punktal" lenses when looked thru obliquely.

The book is well printed and bound, on thin but opaque paper, with strong cloth binding. It is worth having either for systematic study of ophthalmic optics, or as a book of reference. For the latter purpose, the five page index seems fairly adequate.

E. J.

**Diseases of the Eye. George E. de Schweinitz,** M. D., L.L.D., Sc. D., Professor of Ophthalmology in the University of Pennsylvania. Tenth Edition, Cloth, 8 vo., 865 pages, 434 illustrations and 7 colored plates. Philadelphia and London, W. B. Saunders Co., 1924.

What was said in our notice of the Ninth Edition (A. J. O., 1922, v. 5, p. 326) is again illustrated. Such a book does not continue to sell because it *was* the best book, but because it *is kept* the best book on its subject. This edition has been reset, there are about twenty-five new illustrations and, to quote the preface: "Reference to the following subjects is made either for the first time or, having been previously included, has been somewhat elaborated: The Diaphragm Lamp (Gullstrand); Contact Illumination; Binocular Visual Acuteness, and Illumination and Acuteness of Vision; Sunlight as a Source of Illumination in Ophthalmoscopy; Simple Centric Ophthalmoscopy (Gullstrand); Ophthalmoscopy with Red-free Light; Agricultural Conjunctivitis (Patton and Gifford); Striate Clearing of Corneal Opacities; Uveoparotitis; Hernia of the Vitreous; Senile Changes in the Optic Nerve; Temporary Amaurosis in Infants; Butyn; Extraction of Cataract by Suction (Barraquer's method); Subconjunctival Excision of pterygium (Ziegler); Tendon Transplantation; Muscle Recession with Scleral Suturing; O'Connor's "Cinch Shortening Operation."

Most ophthalmologists would not care to fill up their shelves with successive editions of the same textbook. But, since the work of Mackenzie, there has been no other book on ophthalmology of which successive editions so nearly reflected the most recent additions to the literature. We find here references to the works of Vogt and Koeppe and to the American papers on slit lamp microscopy, Gullstrand's "diaphragm lamps" demonstrated at the Washington Congress, Sir William Lister's views regarding retinal disease, Basil Graves' "contact illumination," etc.

In brief, as handbook for students and practitioners, de Schweinitz' "Diseases of the Eye," is still as worthy as ever of the preeminénce it has attained among complete treatises on ophthalmology published in the English language.

E. J.

**Transactions of the College of Physicians of Philadelphia,** Third series, Vol. 45, 1923. Cloth, 8 vo., 926 pages, 33 illustrations. Edited by Walter G. Elmer, M. D., Printed by the College, Philadelphia.

This volume contains in addition to the Transactions, the list of officers, committees, Fellows, former Presidents, lists of those who have been awarded its various prizes, etc. There are also the abstracts of the proceedings of its five sections: on Ophthalmology, Otology and Laryngology, General Medicine, Medical History, Public Health and Industrial Medicine.

The proceedings of the section on Ophthalmology have already been pub-

lished in this JOURNAL with some of the papers, in full, that were read before it and appear here in abstract. Outside of the work of this section this volume contains a paper by Dr. E. A. Shumway on the Treatment of Ocular Syphilis and a report and discussion "Health Work in the Public Schools," which have some special interest for ophthalmologists. There is also a lecture on the "Use of Insulin in the Treatment of Diabetes Mellitus," by Dr. F. G. Banting of Toronto; that is of interest to all who have to deal with diabetes and its effects.

A paper on "The Reaction of Paratonsillar Tissues to Tonsillectomy" is worthy of study on the part of many readers who are also practicing otolaryngology. This latter paper is by Drs. George Fetterolf and Herbert Fox. There is a brief but most suggestive paper by Dr. Haven Emerson of New York City entitled "Preventive Medicine the Opportunity of the Private Practitioner," which should prove suggestive to every reader. The underlying thought is "Preventive medicine can be made more effective thru the family budget than by adding to tax supported public functions."

Of the papers, lectures and addresses published in this volume the majority are by Fellows of the College, but an important part is from its invited guests. These include several from the neighboring cities of New York and Baltimore, but also two from Canada and one each from Switzerland and Tunis. This is the largest volume of Transactions the College has ever issued. The publication of such an annual volume and the maintenance of its library, meeting halls and collections is a series of services to the profession of which an organization might be proud. But the bringing to Philadelphia of the active minds of other cities and other lands is not the least of its achievements.

E. J.

## CORRESPONDENCE.

### Oxyoptric Tables.

*To the Editor:* Hitherto the scientific testing of visual acuity has been neither uniform nor mathematically exact. Some ophthalmologists are expressing the vision in fractions according to Snellen, others accepted the principles of the ophthalmologic congress of Naples and note the vision in decimals. Till now it has been determined by the reciprocal value of the visual angle expressed ir minutes.

The determination of the oxyoptric system of Blaskovics is founded on the oxyoptre, viz. the reciprocal value of the visual angle expressed in degrees. By this method fractions are eliminated, which means a great advantage, from a practical point of view. The letters used on the oxyoptric testtypes are chosen with regard to their angle of recognition, being identical with that of the Landolt ring.

The series contains two large and three small charts; on two of the smaller charts there are Landolt's rings, on the third an Ammon sign. On the back of the smaller charts the tables of equivalent values are to be found, by the means of which we can determine the relation of the international values or those of Snellen to the oxyoptres. On the large charts letters as well as Landolt's rings and Ammon signs are used; thus each examiner may choose that method which he finds most convenient, or best adapted to the intelligence of the patient.

A reflecting lamp, constructed for Blaskovics and obtainable at Calderoni's (Budapest) gives the necessary continuous and equal light.

Enclosed with the charts are full explanations of the oxyoptric system in four languages: English, French, German and Hungarian. This system has been demonstrated before the Society of Hungarian Ophthalmologists and reported in foreign scientific journals some ten years ago. Since then both Blaskovics and his pupils have been using it constantly. I warmly recommend this method to all practitioners and especially to ophthalmologic clinics and hospitals, as it well deserves to be adopted universally.

Budapest, Hungary J. Fejer.

# ABSTRACT DEPARTMENT

Reprints and journal articles to be abstracted should be sent to Dr. Lawrence T. Post, 520 Metropolitan Building, St. Louis, Mo. Only important papers will be used in this department, others of interest will be noticed in the Ophthalmic Year Book.

**Smith, Priestley. Color-Rings, Druault's Test, and Lens Disturbance.** Brit. J. Ophth. v. 8, No. 4, April, 1924, p. 145.

This contribution summarizes the work of observers, such as Druault, Morax, Elliot, Schiötz, Fuchs and others. It is accompanied by fifteen references and five illustrations. The author relates his own personal experience, in order to call attention to a useful differential test and also that this record may be a useful warning. Because the lental ring is frequently physiologic, and, tho often discoverable when carefully looked for, is seldom noticed otherwise, Druault's test seems to have attracted little notice for many years.

The appearance of a ring of rainbow colors round a light is due to diffraction, that "slight tendency to bend round corners," exhibited by light waves "when part of a wavefront is intercepted by one or more opaque obstacles." A grating of parallel straight lines diffracts the light only in the direction perpendicular to the lines. When the lines are distributed in spoke like fashion the light diffraction forms a color ring. Passing a screen before the eye, so long as it does not cover more than half of the pupil, the ring remains entire, but if more than half is covered the light will strike no vertical fiber bundles and will no longer be diffracted horizontally. A grating of fine particles diffracts in all directions. With a screen covering more and more of the pupil it does not disappear in segments; so long as it is visible it is entire. That is what happens when a glaucoma ring is tested with a screen.

The size of a color ring is best stated in degrees and minutes, for it then holds good for all distances. Small doubt exists as to which are the parts that cause these rings. Various experiments have shown that the vitreous is not involved. Disturbance of the lens fibers has been found to produce diffraction. The epithelium of the lens of the calf, when separated from the fibers and stained, gave well marked diffraction rings. Intact cornea, giving diffraction rings, when removed and stripped of endothelium the rings disappeared. Edema from the nerve fibers of the cornea collect under the epithelium producing the well known ring in glaucomatous eyes. Particles on the cornea such as blood or pus give brilliant diffraction rings.

Unmindful of the author's own caution, given in a contribution in 1878 when studying certain glaucoma problems, of the dangers of applying incautiously repeated great pressure to the globe, he now records the effect such a procedure has induced in his own eye.

In 1920, at the age of 74 years, he observed a rainbow ring with his right eye. The eye had altered in focus previously causing him to surmize that the condition was lental. Since first observed it has always been present when looked for. It is best seen with a single small moderately bright light, surrounding surfaces being comparatively dark. It shows from without inwards, zones of red, faint yellow, green and sometimes feebly seen blue. The yellow zone subtends 6°. The brightness of the ring varies with the size of the pupils. With the screen test the ring disappears in segments. With the left eye he has never observed a color ring. Formerly both eyes had a low degree of compound myopic astigmatism. Definite inequality in refraction was recorded at the age of 71 years. In February, 1924, R. E.—7—1.5×45 V=5/7 L. E.—37—87×55=5/3. In addition to the increased myopia of the right eye polyopia has developed. The right lens shows a centrally placed, deeply seated, hazy patch, not sharply defined and not dense enough to hide the red fundus.

The changes may be merely those of ordinary cataract with no unusual

origin, but the author suspects that they were started by finger pressure on the eye in 1917 while studying retinal blood pressure. The changes in the lens afford no proof, but at least they are consistent with the author's suspicion. The chief opacity lies in lower part of the lens, where the pressure of the finger would be likely to take chief effect. The complete absence of a color ring and the nearly complete absence of refractive change in the left eye, in spite of peripheral striae, suggests an additional factor for these changes in the right.

D. F. H.

**Malling, B. Relation Between Iridocyclitis and Glaucoma.** Acta Ophth., v. 1, No. 2, 1923.

After von Graefe published in 1869 a number of cases of iritis with increased intraocular pressure, a number of authors have studied the relation of glaucoma to iritis and cyclitis. The consensus of opinion seems to be that inflammatory processes in the iris and ciliary body are of importance for the production of increased intraocular pressure; that they may manifest themselves under a clinical form very similar to glaucoma and that the more accurate our methods of examination become, the more frequently we find in glaucoma changes in the iris and ciliary body.

With these points of view in mind Malling has studied the relation between iridocyclitis and glaucoma in 360 patients: 184 had iridocyclitis with normal or minus Tn, 90 cases had iridocyclitis with plus Tn, and 86 cases had glaucoma, 105 of those with plus Tn were not examined with the slit lamp, and 77 were found to have primary glaucoma and 28 to have secondary glaucoma. 71 were examined with the slit lamp, and 9 were found to have primary glaucoma and 62 secondary glaucoma. The author believes this to show that a more exact method of examination reveals, that a large number of socalled primary glaucoma patients are in reality secondary glaucoma cases, and that the pathology is taking place in the uvea, preferably in the ciliary body. Furthermore a careful study of these patients leads one to the conclusion that there is a striking similarity as to clinical appearance and course between iridocyclitis with increase of tension and primary glaucoma, and that there seems to be no well defined borderline between these two clinical pictures; altho their extreme types appear so different from each other.

The author thinks that even the cases of iridocyclitis with minus or normal Tn are not entirely different from the first two groups, and all three are of the same nature. They are all caused by the same agent and only minor factors determine the type of the same disease. In favor of this conception he brings forth the following argument: That in cases of iridocyclitis or glaucoma there are periods of exacerbation and remission. That some acute cases gradually pass in to the chronic form, ending in complete loss of vision; that benign cases of iridocyclitis have normal or minus Tn, while the malignant cases are of the glaucoma type.

The mixed forms are the most interesting, and the ones proving—according to the author—the relationship between glaucoma and iridocyclitis. There are patients getting a succession of 2 or 3 attacks of iridocyclitis with high and low tension in the same eye, or attacks of iridocyclitis with plus Tn in one and with minus Tn in the other eye, or with primary glaucoma in one and cyclitis in the other eye; finally other cases may have a succession of attacks of glaucoma, and cyclitis in the same eye.

M. J. S. SCHOENBERG.

**Benedetti, de. Diathermia in Ophthalmology.** Ann. di Ott. e Clin. Ocul., vol. 51, p. 979.

The article is a complete and concise review of recent reports of diathermia by ophthalmologists. The method employs a current of high amperage (up to 3000 milliampers) and low voltage, with very regular and rapid oscillations. By using electrodes on either side of the body, at any point, an increase of heat is produced in the deeper parts between the electrodes

without any of the undesirable effects usually associated with such currents. This intense heat apparently produces a remarkable antispasmodic and analgesic effect. The accompanying marked hyperemia increases local metabolism, and seems to have an actual effect on infections; and it is possible to administer very accurate doses of heat to any given part.

The first work on diathermia in ophthalmology was done by Krückmann in 1911, who estimated the amount of heat which would be tolerated by the eyes of animals. Further work was done by Zahn, Clausnizer and Sattler, on the human eye. It was found that no damage was produced to the external structures, or the lens, by repeated heating to 42° C. The tension was slightly increased, and the albuminous content of the aqueous was increased, apparently by the ciliary hyperemia produced. The temperature within the conjunctival sac could be raised easily to 43.6° C., which is well below the temperature at which damaging effects are produced (45° C.). This may be compared with temperatures of 37.5° C., which Hertel was able to produce with hot packs; and of 40° C., obtained by Turin with the electric thermophore. A number of special electrodes have been devised, such as that of Bucky, a cup shaped device fitting the orbital border, within which fluid is contained which is heated to the desired temperature.

Good results are reported in neuralgia of the orbital nerves, blepharitis, edema of the lids, iritis, cyclitis, etc. Since the gonococcus is killed at a temperature of 40° C., it is especially valuable in gonorrhea. (Krückmann, Best, Quirin.) Quirin observed good results in interstitial keratitis. Koeppe found that it assisted materially in clearing up vitreous opacities. Reports on the treatment of serpent ulcers, panophthalmitis, glaucoma and perforating wounds have been unfavorable. Besides its ordinary use in the administration of heat, the diathermic current may also be used for electrocoagulation as in epilation or destroying small tumors.

Bibliography of the principal reports since 1912 is appended.

S. R. G.

**Pascheff, Prof. C. Differential Diagnosis Between Parinaud's Conjunctivitis and Conjunctivitis Necroticans Infectiosa.** Brit. J. Ophth., v. VIII, no. 1, p. 25.

Despite the many reports of observations on this subject the exact nature of the disease remains obscure. The only undoubted similarity of the many published case reports for which the author proposed the term "Parinaud's Syndrome" is the presence of a unilateral conjunctival inflammation, accompanied by suppuration in the preauricular and submaxillary glands and a rise of temperature.

From this chaos of socalled Parinaud's disease, Pascheff has separated a type of conjunctivitis with definite symptomatology, evolution, pathologic anatomy and etiology, which he calls "Conjunctivitis Necroticans Infectiosa." The one definite criterion that served to distinguish it from other cases of Parinaud's disease was the effect of inoculation on guinea pigs and rabbits which caused the death of these animals with characteristic white spots in the spleen.

A brief comparative resumè of the author's results and those of Parinaud is given. The general symptoms and temperature were similar. Parinaud's conjunctivitis shows large granulations or red vegetation. C. Necroticans small, millet seed, white spots, some slightly elevated, others excavated and ulcerated. After ulceration they clean and cicatrize while fresh spots appear in other parts. In Parinaud's, the granulations were present after two months' cauterization with silver nitrat. C. Necroticans, the inflammation is acute, the spots disappear in two or three weeks. The glandular affection may last two or three months.

Parinaud gives no pathologic anatomy. Morax describes a conjunctiva infiltrated by lymphocytes and macrophages. Derby and Verhoeff describe a necrosis with the absence of polynuclear leucocytes. C. Necroticans shows polynuclear leu-

cocytes, tissue cells in active proliferation, a peripheral zone of lymphocytes. In the foci, necrosis rapidly develops. Parinaud failed to get any results from experimental inoculations. C. Necroticans gave successful inoculations in all cases in guinea pigs and rabbits, which died and showed reproduced spots in the spleen. Parinaud showed no bacteriologic results. From C. Necroticans he was able to isolate an organism, which the investigator has named "Micrococcobacillus polymorphicus necroticans." The disease is reproduced in guinea pigs by inoculation with the organism.

The belief is growing that Parinaud's conjunctivitis is a syndrome of symptoms and not a definite disease. Its pathologic anatomy and bacteriology has not been fully described. Conjunctivitis Necroticans Infectiosa does not appear in the inflamed conjunctiva under the form of vegetations; but of abscesses with central necrosis, which on the surface appear as white spots and ulcers, the deeper ones appear as yellow grains. Four microphotographs and a bibliography of ten references accompany the contribution.

D. F. H.

**Peter, Luther C. Relation of Exophoria in Early Presbyopia to Refractive Errors.** Brit. J. Ophth. v. VIII, No. 1, 1924, p. 20.

The author councils routine muscle studies in all refraction cases. An outstanding fact in his experience is the gradual increase of exophorias encountered between the ages of thirty to fifty years. Two types present; first, carry overs, those in which the condition is present in early adult life and increases as waning accommodation of presbyopia advances. The second, "accommodative exophorias," those due to failing accommodation. They include much the larger number, and this is the type which the paper is concerned with. The majority of these patients have never worn glasses or at least are improperly glassed. They are the patients who have the most symptoms, greatest degrees of exophoria and are the most difficult to handle.

Two or three diopters of hyperopia may cause little trouble before the age of 37 years. Close work begins to be inconvenient. Unwilling to wear glasses constantly a full correction is prescribed for near work, thus disturbing the relationship between accommodation and convergence. Indistinct near vision, headache, redness of lids and vague gastrointestinal disturbance are the symptoms complained of. The mode of treatment is careful cycloplegic refraction. Muscle exercise divided itself into two groups; first, prism exercise for those manifesting exophoria for distance and a greater degree for near; second, stereoscopic exercises, combined with prism exercises with esophoria for distance and exophoria for near. In this group both adduction and abduction may be above normal but improperly balanced.

D. F. H.

**Gjessing, H. G. A. Results of Holth's Iridencleisis for Chronic Glaucoma.** Norsk Magazin for Laegevidenskaben. v. 84, p. 1045.

The author reviews the results in 76 cases of chronic glaucoma on which he used Holth's operation. Of these, 61 only are included in the review, the records being incomplete in the rest. The reported cases had been observed from 12 to 116 months after operation. Fifty of the 61 maintained the same vision as before the operation. Of the remaining 11, four became blind, even tho in two cases the tension became and remained normal. One became blind from a preretinal hemorrhage; two who had very contracted fields lost the vision, 12 and 17 months after the operation.

Forty-nine showed a normal tension without use of miotics and no case revealed the deplorable hypotony, so common after trephining. The fields were the same or enlarged in 47; the earlier the operation had been done the better the results. The method seemed less dangerous, in cases with greatly reduced vision and contracted fields, than the classical iridectomy. No case of late infection or of sympathetic inflammation occurred. No thin bleb like swelling of the conjunctiva over the scar was found in any case—unlike the common appearance of

these after trephining. The author concludes that Holth's operation is surer in results and relatively less dangerous than other operative procedures in chronic glaucoma.

D. L. T.

**Braun, G. and Haurowitz, F. Experiments on Injuries by the Cauterization of the Cornea by Lime.** Klin. M. f. Augenh. 1923, v. 70, p. 157.

The essential basis of opacities from cauterization of the cornea by lime is a colloidal chemical phenomenon, an irreversible loosening or intramolecular transposition of the corneal mucoid by the lime. The presence of lime in the cornea was proven histologically. If there is carbonat of lime, the carbonic acid is exogenous and its combination with lime secondary. If alcohol was not employed mucoid was still present. Ammonium lactat which dissolves lime compared with ammonium tartarat in the proportion of 10.5 to 0.0185 had no influence on the opacity. This was a new proof that combinations of lime, arising after cauterization of the cornea, are unessential for the typical opacity. After treatment with the kation (ammonia) a gradual conversion of the dense white opacity into a slighter grey with clearing of it from the margin occurred. The sedimented mucoid is supposed to be dissolved under conversion into alkali albuminate and thus a clearing is attained. The acid ion is irritating.

The ammonium lactat, on account of its lime dissolving faculty and its relatively slight irritation compared with other acid salts, may be used at the first cleansing of the conjunctival sac instead of pure water.

C. Z.

# NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. They should be sent in by the 25th of the month. The following gentlemen have consented to supply news from their respective sections: Dr. Edmond E. Blaauw, Buffalo; Dr. H. Alexander Brown, San Francisco; Dr. V. A. Chapman, Milwaukee; Dr. Robert Fagin, Memphis; Dr. M. Feingold, New Orleans; Dr. Wm. F. Hardy, St. Louis; Dr. Geo. F. Keiper, LaFayette, Indiana; Dr. George H. Kress, Los Angeles; Dr. W. H. Lowell, Boston; Dr. Pacheco Luna, Guatemala City, Central America; Dr. Wm. R. Murray, Minneapolis; Dr. G. Oram Ring, Philadelphia; Dr. Chas. P. Small, Chicago; Dr. John E. Virden, New York City; Dr. John O. McReynolds, Dallas, Texas; Dr. Edward F. Parker, Charleston, S. C.; Dr. Joseph L. McCool, Portland, Oregon; Dr. Richard C. Smith, Superior, Wis.; Dr. J. W. Kimberlin, Kansas City, Mo.; Dr. G. McD. Van Poole, Honolulu; Dr. E. B. Cayce, Nashville, Tenn.; Dr. Gaylord C. Hall, Louisville, Ky.; Dr. Edward D. LeCompte, Salt Lake City.

### DEATHS.

The death of Dr. Henry Parent, formerly president of the Ophthalmologic Society of Paris, at the age of seventy-five, has been announced.

George H. Oliver of Bradford, England, died on April fourteenth at the age of sixty-three. He was formerly lecturer in ophthalmology at the University of Oxford.

The death of Dr. Michael Mohr, associate professor in the University of Budapest, chief physician of the ophthalmologic section of the Jewish Hospital, has been announced.

### PERSONAL.

Dr. Thad W. Ashley of Kenosha, Wisconsin, has opened a private Eye, Ear, Nose and Throat Hospital, at 260 Chicago Street.

Dr. Frederick H. Verhoeff of Boston has been appointed professor of ophthalmic research in the Medical School of Harvard University.

Dr. Aaron Barlow of Philadelphia has recently been appointed Clinical Assistant in the service of Dr. Pontius.

Dr. Alfred Cowan of Philadelphia has been appointed Assistant Surgeon to Wills Eye Hospital in association with Dr. B. F. Baer.

Dr. Lyn Waller Deichler who was formerly a clinical associate in Dr. Radcliffe's service has been appointed Assistant Surgeon in the clinic of Dr. Paul J. Pontius.

Dr. G. F. Keiper of LaFayette, Indiana, was elected chairman of the middle section of the American Laryngological, Rhinological and Otological Society at its recent meeting at St. Louis in May.

Dr. L. W. Morsman of Hibbing, Minnesota, sailed for Europe on the Steamship Volendam, June fourteenth. Dr. Morsman expects to do postgraduate work in opthalmology in Vienna and elsewhere until June, 1925.

Dr. Thomas A. O'Brien of Philadelphia who has been Assistant Surgeon in the Clinic of Dr. Paul J. Pontius was elected Surgeon to Wills Eye Hospital to succeed Dr. Radcliffe.

Dr. Julius Fejér, collaborator of our journal, has been appointed Chief Physician of the ophthalmologic section of the Jewish Hospital in Budapest.

Dr. L. Webster Fox, President of the College Board of Trustees of the Pennsylvania Military College, conferred upon Brigadier General Smedley D. Butler the degree of Director of Public Safety.

Dr. George S. Derby, assistant professor of ophthalmology, Medical School of Harvard University, has been appointed Williams' professor of ophthalmology to succeed Dr. Alexander Quackenboss, who retired.

Dr. Frank Allport of Chicago has written a story, a true story, of the rescue of a prostitute. "Miss Helder" is the name of the story. Doctor and Mrs. Allport are to be congratulated upon the heroic and tenacious efforts made in getting the girl back to a normal life.

Dr. George deSchweinitz of Philadelphia was recently presented in Paris with a plaquette by the French Ophthalmological Society in recognition of his eminent services to Ophthalmic Science, and was given an ovation upon his presentation by Dr. Dor of Lyons, president of the congress.

Dr. McCluney Radcliffe of Philadelphia, who has been associated with Wills Eye Hospital in various official positions for twenty-six years, has recently resigned as surgeon to that institution. In recognition of Dr. Radcliffe's long continued and faithful service the Board of Directors of City Trusts have made him a consulting surgeon to the institution.

Dr. Thomas B. Holloway has been elected Professor of Ophthalmology in the Medical School of the University of Pennsylvania to succeed Dr. George E. deSchweinitz, who recently resigned after having served the University with outstanding distinction for twenty-two years. Dr. Holloway has been in intimate professional association with the Ophthalmologic Department of the University during Dr. deSchweinitz' entire incumbency and has been Professor of Ophthalmology in the Postgraduate School of the University since its organization and Vice Dean since 1919.

SOCIETIES.

At a meeting of the Nebraska Academy of Ophthalmology and Oto-Laryngology in Omaha, May twelfth, Dr. S. E. Cook, Lincoln, was elected president; Dr. H. B. Lemere, Omaha, vice president, and Dr. Clarence Rubendall, Omaha, secretary.

The closing meeting and annual dinner of the Brooklyn Ophthalmological Society were held on May 25th, 1924. Dr. Henry M. Smith presided as toastmaster. Dr. Frank D. Jennings spoke on Medical Civics, stressing the function of the county medical society as the clearing house for medical truths. The Reverend Andrew Fleming drew inspiring parallels between spiritual and ocular vision.

At the regular business meeting, the following were elected officers for the coming year: Ralph I. Lloyd, M.D., President; E. Clifford Place, M.D., Vice-President; Henry Minsky, M.D., Secretary-Treasurer; Joseph E. Golding, M.D., Henry M. Smith, M.D., James H. Andrew, M.D., Members Elect of the Executive Committee.

MISCELLANEOUS.

"The School Magazine," a Braille magazine for blind children has been established in England, reported to be the first of its kind. It contains essays, poetry, humor and a competition page. Children's Bureau, U. S. Dept. of Labor.

Beginning with October, 1924, Dr. George F. Suker will hold a fundus diagnostic clinic at the Cook County Hospital, Chicago, from 2 to 5 p. m. on the third Monday of each month, the day upon which the Chicago Ophthalmological Society meets. In order that all may receive full advantage of material the number of visitors will be limited to ten. Those desiring to attend the clinic are requested to write in advance to Dr. G. F. Suker, 25 E. Washington Street, Chicago.

Lately it has been intimated that compulsory vaccination should in some measure be mitigated. One of the chief advocates of this erroneous idea is Grottjahn, who appears to be a great apostle of the liberty of man. Contrary to this, Professor Hess has compiled the statistics of the blind people who contracted blindness in consequence of smallpox. From these statistics it is clearly seen that in those lands where there is no compulsory vaccination, the number of blind persons is enormously greater in comparison to states where there is compulsory vaccination in the first year of life.—(*Vienna letter, Med. Jour. and Rec.*, 1924, v. 119, p. 623.)

In the House of Commons was read a second time a bill proposing that every blind person who has attained the age of 30 shall be entitled to receive such pension as under the Old Age Pensions Act he would be entitled to receive if he were 70 years of age. The present pension age is 50. According to the bill, county councils and county borough councils are to make arrangements to the satisfaction of the ministry of health for promoting the welfare of blind persons ordinarily resident within their area, by providing and maintaining workshops and hotels and homes for them. Those employed in the workshops are to be paid remuneration not less than the average standard rate received by unskilled laborers in the district. The blind must be no longer left solely to the care of institutions, splendid as has been the work they have done in the past. The number of blind persons in England and Wales from one year of age upward is 36,578. Those trained and employed amount to 8,239; those under training only to 1,246; and those unemployed, who are between the ages of 30 and 70, number 20,759.

The government attached considerable importance to steps for the prevention of blindness. Apart from industrial and other accidents, blindness was in large measure preventable. Every effort should be made to eliminate preventable blindness, and to that question the minister of health was now giving his attention.

# Current Literature

These are the titles of papers bearing on ophthalmology. They are given in English, some modified to indicate more clearly their subjects. They are grouped under appropriate heads, and in each group arranged alphabetically, usually by the author's name in **heavy-faced type.** The abbreviations mean: (Ill.) illustrated; (Pl.) plates; (Col Pl.) colored plates. Abst. shows it is an abstract of the original article. (Bibl.) means bibliography and (Dis.) discussion published with a paper. Under repeated titles are given additional references to papers already noticed. To secure early mention, copies of papers or reprints should be sent to American Journal of Ophthalmology, 217 Imperial Building, Denver, Colorado.

### Books

**Franke, E.** Die augenärtzliche Therapie. 146 pages, Berlin, Julius Springer, 1924. A. J. O., 1924, v. 7, p. 485.

**Harman, N. B.** Religion and the new psychology. London, Lindsey Press, 1924. Lancet, 1924, May 31, p. 1111.

**Marlow, F. W.** Relative position of rest of eyes and prolonged occlusion test. Cloth, 104 pages, illustrated with original diagrams and charts, F. A. Davis Co., 1924, Philadelphia. A. J. O., 1924, v. 7, p. 484.

**Terrien, F.** and **Cousin, G.** Affections de l'oeil en médecine générale. Diagnostic et traitement. 510 pages, 128 figures. Masson et Cie, Paris, 1924. Arch. d'Opht., 1924, v. 41, p. 313.

Transactions American Academy of Ophthalmology and Oto-Laryngology. Twenty-eighth annual meeting. 545 pages, 11 plates, 2 in colors, 127 illustrations. Chicago, published by the Society. A. J. O., 1924, v. 7, p. 486.

Transactions of the American Ophthalmological Society, v. 21. Fifty-ninth annual meeting, Colorado Springs, 1923. 428 pages, 27 plates, 3 in colors, 8 illustrations, Philadelphia, published by the Society. A. J. O., 1924, v. 7, p. 487.

### DIAGNOSIS.

**Andrade, G.** Detection of simulation. Brazil Med., 1924, v. 38, pp. 167-170.

**Bailliart** and **Nunès.** Scleral tonometry. Ann. d'Ocul., 1924, v. 161, p. 383.

**Butler, T. H.** Practical value of slit lamp. (1 pl.) Brit. Med. Jour., 1924, May 31, pp. 945-948.

**Crampton, G. S.** Ophthalmic column for oculists' consulting rooms. A. J. O., 1924, v. 7, p. 464.

Standard illumination visual acuity test cabinet. A. J. O., 1924, v. 7, p. 465.

Automatic device for controlling illumination. A. J. O., 1924, v. 7, p. 465.

**Fischer, F. P.** Spectroscopy of anterior segment of globe. (1 ill.) Graefe's Arch. f. Ophth., 1924, v. 114, pp. 113-122.

**Kimpton, R.** Importance of routine eye examinations. Nation's Health, 1924, v. 6, pp. 321-323.

**Koby, F. E.** Shadows projected in microscopy of living eye. (2 ills.) Arch. d'Opht., 1924, v. 41, pp. 271-277.

**Lenz, G.** Sterocamera for photography of anterior segment of eye. (3 ills.) Klin M. f. Augenh., 1924, v. 72, pp. 33-47.

**Maggiore, L.** Perimetry using spectral colors as test. (5 ills. bibl.) Ann. di Ottal. e Clin. Ocul., 1924, v. 52, pp. 247-272.

**Peter, L. C.** Corneal microscope and slit lamp studies. A. J. O., 1924, v. 7, pp. 462-463.

**Thorning, W. B.** and **Lapat, W.** Relative value of fundi findings and other clinical symptoms in operative interference in head injuries. (dis.) Texas State Jour. Med., 1924, v. 19, pp. 683-687.

Repeated title. **Pacalin.** (A. J. O., 1924, v. 7, p. 414.) Intern. Sur. Ophth., 1924, v. 7, p. 161.

### THERAPEUTICS.

**Allen, B.** Practical value of x-ray to eye, ear, nose and throat specialist. Jour. Iowa State Med. Soc., 1924, v. 14, pp. 210-214.

**Bourguignon, G., Cantonnet,** and **Joltrois, M.** Ionization in ocular therapeutics. Presse Méd., 1923, June 9. Abst. Gaz. des Hôp., 1924, v. 97, p. 361.

**Carrere.** Local vaccination in ocular therapeutics. Ann. d'Ocul., 1924, v. 161, p. 300.

**Clarke, E.** Treatment of common eye disorders. Clinical Jour., 1924, May 7, pp. 217-222.

**Corbett, J. J.** Radium clinic for eye, ear, nose and throat conditions. Boston Med. and Surg. Jour., 1924, v. 190, pp. 1082-1084.

**Denti, A. V.** Bismuth treatment of syphilitic eye symptoms. Gior. di Ocul., 1924, v. 5, p. 21. Abst. Intern. Sur. Ophth., 1924, v. 7, p. 167.

**Gold, H.** Seat of mydriatic action of cocain. Jour. Pharmacol. and Exper. Therap., 1924, v. 23, pp. 365-373.

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**Nichelatti, P.** Insulin and ocular surgery in diabetes. Lettura Oft., 1924, v. 1, pp. 21-25. Abst. J. A. M. A., 1924, v. 82, p. 1998.

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**Pollice, F. R.** Injection of milk in ophthalmology. Lettura Oft., 1924, v. 1, pp. 10-21. Abst. J. A. M. A., 1924, v. 82, p. 1998.

**Rollet.** Radiotherapy in ophthalmology. Abst. Arch. d'Opht., 1924, v. 41, p. 315.

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**Mayer, E.** Toxic effects of local anesthetics. A. J. O., 1924, v. 7, pp. 477-480.

**Proksch.** Method of keeping clear field of operation. Klin. M. f. Augenh., 1923, v. 71, p. 776.

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**Comberg.** Psychology of depth perception. Zeit. f. Augenh., 1924, v. 31, p. 183.

**Kuroda, G.** Measurement of binocular space threshold of mosaic vision. Acta Scholae Med. Univer. Imper. Kioto, 1924, v. 5, pp. 43-48.

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**Molinie, J.** Binocular telescopic lens. Acta. Oto-Laryng., 1924, v. 5, p. 408. Abst. Intern. Sur. Ophth., 1924, v. 7, p. 181.

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**Trendelenburg, W.** Improved attachments and illumination of Zeiss binocular lens. Acta Oto-Laryng., 1924, v. 5, p. 436. Abst. Intern. Sur. Ophth., 1924, v. 7, p. 182.

**Verbitzky, V. C.** Eye and photographic lenses. (2 ills. bibl.) Brit. Jour. Ophth., 1924, v. 8, pp. 280-282.

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**Gamble, W. E.** Why we wear glasses. Hygeia, 1924, v. 2, p. 439.

**Guglianetti, L.** Influence of fatigue on accommodation and amplitude of accommodation. Arch. di Ottal., 1924, v. 31, p. 108.

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